

City of Seattle

South Holgate Street Railroad Crossing Study

Phase II

FINAL REPORT

Prepared for:



Prepared by:



Fehr & Peers

11410 NE 122nd Way, Suite 320
Kirkland, Washington 98034-6927
(425) 820-0100

January 2010

Acknowledgments

Seattle Mayor

Mike McGinn

Seattle City Council

Richard Conlin, Council President

Sally Bagshaw

Tim Burgess

Sally J. Clark

Jean Godden

Bruce Harrell

Nick Licata

Mike O'Brien

Tom Rasmussen

Seattle Department of Transportation

Grace Crunican, Director

Tracy Krawczyk, Planning Manager

Tony Mazzella, Strategic Advisor, SDOT Project Manager

Sara Robertson, Associate Transportation Planner

Washington State Department of Transportation

Ali Amiri, Project Oversight Manager

Barbara Ivanov, Freight Systems Division

Dale Tabat, Freight Systems Division

Scott Witt, Freight Systems Division

Consultants

Tom Noguchi, Fehr & Peers Project Manager

Robert Sicko, Fehr & Peers Associate

Joel Rabinovitz, Fehr & Peers Senior Planner

Neha Rathi, Fehr & Peers Transportation Planner

Tiiki Rysen, Fehr & Peers Graphics Specialist

Virginia Brix, Fehr & Peers Editor

Other Contributors

Jonathan Hutchison, Amtrak

Megan McIntyre, BNSF

Martin Young, Sound Transit

Eric Beckman, Sound Transit

Christine Wolf, Port of Seattle

Peter Whitehead, Seattle Freight Mobility Advisory Committee

Pat Binyon, Seattle Freight Mobility Advisory Committee

Marilyn Young Skogland, Duwamish Transportation Management Association

Table of Contents

Executive Summary	1
Purpose of this Study	1
Background	1
Data Gathering and Analysis	2
Conclusions	2
Recommendations	3
Chapter 1. Introduction	1
Background	1
Study Purpose	3
Chapter 2. Prior Plans, Studies and Analyses	5
Access Duwamish	5
S Holgate Street Railway Crossing Closure Traffic Study (2003)	5
S Holgate Street Railway Crossing Closure Traffic Impact Analysis (2005)	6
S Holgate Street Railway Crossing Closure Traffic Impact Analysis – Addendum No. 1	6
Traffic Impact Analysis on S Holgate Street and S Royal Brougham Way Closures	7
Traffic Impact Analysis on S Holgate Street and S Royal Brougham Way Closures	7
Relevant Large-Scale Capital Projects	7
Long-Range Facility Improvement Plans	8
Chapter 3. S Holgate Railroad Crossing Survey Analysis and Results	11
Historical Mainline Train Volumes	11
Comparison of Actual Mainline Train Volumes with Prior Study Forecasts	13
Comparison of Closure Times Forecast by WSDOT	13
Pedestrians and Bicyclists Crossing Railroad TRACKS (East-West)	14
Pedestrians Crossing S. Holgate Street (North-South)	14
Sidewalk Conditions	16
Average Time per Gate Closure	16
Average Time of Gate Closure per Hour	16
Time of Gate Closures by Type of Train Operation	18
Time and Percent of Gate Closures by Train Operator	19
Chapter 4. Existing and Future Traffic Analysis	21
Daily Traffic Volumes	21
Truck Volumes on S Holgate Street	24
Ballgame Day Traffic	26
Existing Levels of Service (LOS)	27
Travel Pattern of Vehicles on S Holgate Street	27
Travel Modes of Commuters	31
2015 and 2030 Travel demand and traffic conditions	32
2015 Operational Analysis	33
2015 Operational Analysis without S Holgate Street	34
2030 Operational Analysis with S Holgate Street	34
2030 Operational Analysis without S Holgate Street	38

Chapter 5. Options for South Holgate Street	41
Option 1. No Action – Keep S Holgate Street Open for Traffic	41
Option 2. Keep S Holgate Street Open with Safety Enhancements	42
Option 3. Close S Holgate Street Permanently	43
Option 4. Close S Holgate Street Permanently for Vehicles Only and Provide Pedestrian/Bike Overpass.	44
Option 5. Close S Holgate Street for Part of Day Depending Upon Level of Railroad Traffic	44
Option 6. Construct a Grade-Separated Crossing Structure to Span the Railroad Tracks	45
Chapter 6. Conclusions and Consultant Recommendation	47
Conclusions	47
Recommendations	48

List of Tables

Table 1. Daily Mainline Train Counts for Freight and Passenger Services	11
Table 2. Comparison of Mainline Train Volumes per Day	13
Table 3. Hourly and Average Train Gate Closure Times (Actual, 2004 and 2009 Data and 2007 and 2027 Forecasts)	14
Table 4. Gate Closure Times by Train Operators During Average Weekday	19
Table 5. Daily Truck Volumes on S Holgate Street by Type of Vehicle (2008)	25

List of Figures

Figure 1. S Holgate Street Railroad Crossing Study Area.....	12
Figure 2. Pedestrians and Bicyclists on S Holgate Crossing the Railroad Tracks (East-West Movements)	15
Figure 3. Pedestrians Crossing S Holgate Street (North-South Movements)	15
Figure 4. Sidewalks on S Holgate Street between 1st Avenue South and 4th Avenue South	16
Figure 5. Average Time of Each Railroad Gate Closure (Weekday)	17
Figure 6. Average Time of Gate Closure in Minutes per Hour	17
Figure 7. Time of Gate Closures by Type of Train Operation.....	18
Figure 8. Daily Traffic Volumes in 2005 – 2006.....	22
Figure 9. Daily Traffic Volume Trends on S Lander Street, S Holgate Street and 1st Avenue S (2000 to 2008)	23
Figure 10. Daily Traffic Volumes on S Royal Brougham Way and 1st Avenue S (2000 to 2008).....	24
Figure 11. Traffic Volumes Plotted by Hour and by Type of Vehicle	25
Figure 12. Westbound Traffic Volumes on Holgate Street between 1st Avenue South and 4th Avenue South	26
Figure 13. Eastbound Holgate Street between 1st Avenue S and 4th Avenue S	27
Figure 14. Existing Intersection LOS on Weekdays without a Baseball Game	28
Figure 15. The Distribution Pattern of the PM Peak Period Westbound Traffic on S Holgate Street.....	29
Figure 16. The Distribution Pattern of the PM Peak Period Eastbound Traffic on S Holgate Street.....	30
Figure 17. Study Area Workers Means of Transportation from Home to Work.....	31
Figure 18. Reconfigured SR 99 Northbound and Southbound Ramps and Streets in the Vicinity of the AWW South Portal Area	33
Figure 19. Lane configuration on the S Royal Brougham Way/1st Avenue S and S Atlantic Street/ 1st Avenue S intersections	34
Figure 20. PM Intersection Level of Service - 2015 Base Conditions.....	35
Figure 21. PM Intersection Level of Service - 2015 with South Holgate Street Closure	36
Figure 22. PM Intersection Level of Service - 2030 Base Conditions.....	37
Figure 23. PM Intersection Level of Service - 2030 with South Holgate Street Closure.....	38

Executive Summary

PURPOSE OF THIS STUDY

This study re-evaluates the proposed consideration to close S Holgate Street between Occidental Avenue S and 3rd Avenue S in light of new information such as a final decision on the replacement of the Alaskan Way Viaduct and an emerging proposal from Amtrak to increase maintenance operations at its facility on both sides of S Holgate Street.

In addition, a key objective was to identify short and long-term capital improvements to enhance the safety and operational performance of S Holgate Street as it crosses the railroad tracks.

BACKGROUND

In 2003, the Washington State Department of Transportation (WSDOT) Rail Office commissioned a study to evaluate the traffic-related impacts of closing S Holgate Street between Occidental Avenue S and 3rd Avenue S as the street crosses the Burlington Northern Santa Fe (BNSF) railroad tracks. The results of this study indicated that the closure of S Holgate Street would eliminate vehicle delays due to trains and that the future levels of service in the SODO¹ area would operate adequately without S Holgate Street. The consultant hired by the WSDOT recommended that the City of Seattle permanently close S Holgate Street at the rail crossings.

After receiving comments from the affected agencies in 2005, the same WSDOT consultant re-evaluated the closure option and issued a new report, which, again, recommended that “S Holgate Street be closed as part of the Amtrak Pacific Northwest Maintenance Facility construction.” This time the recommendation for closing S Holgate Street was tied to the proposed Amtrak maintenance facility construction. However, the report contained limited analysis or discussion about how the operations of the Amtrak facility would affect the duration of the train gate closures or traffic operations on S Holgate Street.

The Seattle Department of Transportation (SDOT) did not support the WSDOT consultant recommendation to close S Holgate Street and took the position that the S Holgate Street would remain open during construction of the Alaskan Way Viaduct replacement project, deferring any additional decision about the future status of S Holgate Street until a later date. In early 2009, the Washington State Legislature decided to fund a bored tunnel concept to replace the waterfront Alaskan Way Viaduct.

Since the release of the 2005 report, the City of Seattle, WSDOT, and other agencies have made several key decisions that would affect traffic in the SODO area, and bear upon the City's ultimate decision about S Holgate Street. The transportation facility improvements that are either under construction or being designed for construction at this time include:

- State Route 519 (SR 519) Phase II – This project will provide a westbound direct access off-ramp from Interstate 90 to S Atlantic Street, a S Royal Brougham Street grade-separated crossing of the railroad tracks, and the widening of the 1st Avenue South/South Atlantic Street intersection. While westbound access will be improved, additional traffic can be expected on Atlantic Street and 1st Avenue S, yet the project will improve AM level of service (LOS) at the intersection.

¹ The SODO Area in this study is defined with the area bounded by S. Jackson Street, I-5,

- South Spokane Street Viaduct Widening and 4th Avenue S and 1st Avenue S Ramps – This project will reduce congestion on the Viaduct and improve overall access, but is likely to attract additional traffic volumes to the SODO area.
- Sound Transit 2 (ST2)– There will be an increase in the number of Seattle to Tacoma “Sounder” commuter rail trains and more trips across South Holgate Street.
- Alaskan Way Viaduct Replacement – The bored tunnel under the Central Waterfront will not include direct access to the Seattle Downtown; therefore, there will be a greater reliance upon SODO arterials (such as Alaskan Way S, 1st Avenue S, and 4th Avenue S).

DATA GATHERING AND ANALYSIS

Fehr and Peers, the consultant to the City of Seattle on this project, and SDOT brought to bear an innovative tool for data-gathering and analysis: video monitoring of the railroad tracks which allowed the project team to collect data previously unrecorded.

Using an SDOT traffic camera, already located on 1st Avenue S and S Holgate Street, the consultant monitored the crossing for one entire week during the month of January 2009. Video surveillance enabled the project team to answer such questions as:

- When are the railroad gates down?
- For how long?
- For what reasons?
- Do closure times vary significantly depending upon time of day?
- How many pedestrians cross the tracks? (At a later time, direct observation focused on pedestrian traffic on a Seattle Mariner game day.)

CONCLUSIONS

- Unlike many commercial areas of the City, the SODO area does not have a traditional street grid network. In particular, the number of east-west arterials in this area is limited. A recent decision to construct a grade-separated structure over the railroad tracks on Royal Brougham Way S will further constrain the east-west traffic movements. In 2008, S Holgate Street carried about 12,000 vehicles per day. The closure of S Holgate Street would not shift this amount of traffic to just one street such as S Atlantic Street, but the impact of the street closure would be felt throughout the area.
- The video recording of the train crossings revealed that the train gates stop traffic movements about 20 percent of the day (about 12 minutes each hour). More than 50 percent of those gate closures are due to freight train operations. As Sound Transit’s commuter rail, WSDOT’s Amtrak *Cascades*, and intercity Amtrak passenger train services increase in the future, the frequency and duration of the train gate closures would increase, resulting in longer delays for vehicles. However, even if the gate closure time were to increase significantly, S Holgate Street would still provide significant access for the area.

- Prior studies did not assess the impacts of a possible closure upon pedestrians. As stated earlier, there are limited east-west street connections in SODO. Any closure of S Holgate would force pedestrians to walk considerable distances to either S Lander Street or S Atlantic Street. On the winter weekday during the video monitoring, 330 pedestrians crossed the tracks; on a baseball game day, between 5 and 7 PM, 426 people crossed the tracks. In addition, on a typical workday, Amtrak employees made 350 crossings of S Holgate.
- S Holgate Street primarily serves SODO businesses, industries, and the stadiums. In addition, S Holgate Street serves the people who live in the Beacon Hill neighborhood and travel to the waterfront or to the northwestern part of Seattle, such as Interbay or Ballard, for work, shopping or recreation. The closure of S Holgate Street would reduce accessibility for those people living on Beacon Hill and others east of I-5.
- As S Holgate Street is located 0.75 miles south of the King Street Train Station, the northbound passenger trains need to slow down as they pass the S Holgate Street crossing to come to a complete stop at the King Street Station, and similarly the southbound trains need to accelerate gradually after departing the train station. The closure of S Holgate Street would not help increase speeds of the passenger train operations.

A grade-separated overpass that carried all modes was considered, but preliminary analysis indicated that this was not a feasible option given its high estimated cost. The challenge presented by the overpass option is that there is not sufficient space to ramp up at a reasonable grade between Occidental Avenue S and the western railroad track, and to ramp down between the eastern track and 3rd Avenue S. A description and schematic design for the bridge structure necessary to achieve the needed clearances is provided later in the report.

While no reported collisions, involving trains, have taken place on the tracks, safety remains a chief concern of both SDOT and the railroad operators. These concerns can be addressed through the implementation of achievable and effective safety improvements which will be described in the next section of this report.

RECOMMENDATIONS

Based on the new information that this study assembled and our best forecast of the future conditions with the transportation improvement projects that were made recently, Fehr & Peers makes the following recommendations.

(1) The City of Seattle should not close S Holgate Street and should keep it open for vehicles and pedestrians except for the times when it is temporarily closed with lowered train gates. *However, if in the future (post-Viaduct replacement), conditions change significantly, such as a very major upturn in the number and duration of gate closures, the implementation of the S Lander Street Grade Separation Project or Amtrak's willingness to help fund a pedestrian and bicycle overpass over S Holgate Street, SDOT would consider revisiting the question of the long-term role of S Holgate Street, and,*

(2) The City and railroad operators should jointly implement the following safety enhancements as high priority capital improvement projects:

- Consolidate crossing gates. (Currently multiple gates are placed on S Holgate Street between Occidental Avenue S and 3rd Avenue S. The purpose of this action is to prevent vehicles from queuing up at one gate and extending back into the next gate.)
- Install quad-gates. (The quad-gates are designed to prevent a vehicle from going around the gate.)
- Complete gaps in the sidewalk system on S Holgate Street between 1st Avenue S and 4th Avenue S.
- Add crossing gates for pedestrians. (Include a pedestrian scaled gate to each quad-gate to prevent pedestrians from crossing the railroad tracks when a train is approaching.)
- Provide raised medians with a pedestrian refuge. Many railroad workers walk across S Holgate Street along the railroad tracks. (The raised medians would provide a space for them to wait for adequate breaks between vehicles on S Holgate Street, and, additionally, create conditions where they only need to cross half of the street at a time.)
- Add U-turn routes. (When drivers encounter a long train gate closure, they should be able to make a safe U-turn to choose an alternate route to cross the railroad tracks at a different cross street, such as S Lander Street or S Atlantic Street. The design of the median would need to accommodate a u-turn maneuver for all but the largest trucks.)
- Provide electronic message signs for drivers on area arterials to show when the train gates are down and provide an indication of how long the gates may be closed.

Chapter 1. Introduction

BACKGROUND

The S Holgate Railroad Street Crossing Study Phase II was initiated by the City of Seattle Department of Transportation (SDOT) with a grant from the Washington State Department of Transportation (WSDOT). This report summarizes the results of prior plans and studies, reviews the options that have been identified for the area, presents Fehr & Peers' updated analysis of baseline and future conditions, and provides recommendations.

The focus of this study is S Holgate Street between 1st Avenue S and 4th Avenue S in the SODO Area, which is located south of the core of Downtown Seattle. Between 1st and 4th Avenue S, S Holgate Street crosses a series of 13 mainline and spur railroad tracks owned by Burlington Northern Santa Fe Railroad (BNSF), and used by several railroad operators including BNSF, Amtrak, WSDOT and Sound Transit. S Holgate Street is a four-lane Minor Arterial street, designated as a Major Truck Street, and part of a network of major roadways that provide crucial routes for both freight and general transportation.

The SODO area contains the majority of the City's industrial land uses and associated industrial employment, but also contains some office, retail, and entertainment uses. Entertainment uses include two major sports stadiums—Qwest Field and Safeco Field. Major employers in SODO include Starbucks corporate headquarters, K2 Sports corporate headquarters, the McKinstry Company, Charlie's Produce, the United States Postal Service, the Port of Seattle, Tully's Coffee, and many more.

The area is also a freight hub, including the Port of Seattle's Terminals 25, 30 and 46 cargo facilities, and two rail yards—BNSF's Seattle International Gateway Rail Yard located west of Colorado Avenue, and Union Pacific's Argo Rail Yard, which cuts diagonally across the southern portion of SODO. As noted earlier, the BNSF mainline tracks run north-south through SODO between Occidental Avenue S and 3rd Avenue S.

Within the study area is a key transit hub – the King Street Station Area - where commuter rail, light rail, inter-city rail, and bus transit link to the surface street system through an interconnected series of stations and stops. Closer to S Holgate Street, two light rail stations serve SODO and the two sport stadiums.

The picture on the next page identifies S Holgate Street, the street system, railroad tracks, and Link light rail stations in the SODO Area.

The aerial identifies street system, LRT stations and railroad tracks in the study area.



Source: Fehr & Peers (2009), map courtesy of Google Earth

STUDY PURPOSE

In 2006, Fehr & Peers (as Mirai Associates) concluded its work on Phase I of the S Holgate Street Railroad Crossing Study and forwarded the following recommendations to the Seattle Department of Transportation (SDOT):

- S Holgate Street and Royal Brougham Way should remain open for traffic through the completion of the Alaskan Way Viaduct and Seawall Replacement Project (currently anticipated to be completed in 2018.)
- Identify near-term improvements to increase vehicle, pedestrian, bicycle and railroad safety.
- Continue to develop alternatives for long-term multi-modal improvements.

In 2007, WSDOT provided funds for SDOT to perform additional analyses of future conditions on S Holgate Street and to formulate actions for the City to undertake. The purpose of the Phase II study is stated as follows:

“To identify and prioritize key short-term (2015) and long-term (2030) transportation needs and improvements in the study area related to the railroad lines across S Holgate Street.”

Since the release of the 2005 report, the City of Seattle, WSDOT, and other agencies have made several key decisions that would affect traffic in the SODO area, and bear upon the City’s ultimate decision about S Holgate Street. The transportation facility improvements that are either under construction or being designed for construction at this time include:

- State Route (SR 519) Phase II. – This project will provide a westbound direct access off-ramp from Interstate 90 to S Atlantic Street, a S Royal Brougham Street grade-separated crossing of the railroad tracks, and the widening of the 1st Avenue South/South Atlantic Street intersection. While westbound access will be improved, additional traffic can be expected on Atlantic Street and 1st Avenue S.
- South Spokane Street Viaduct Widening and 4th Avenue S and 1st Avenue S Ramps. – This project will reduce congestion on the Viaduct and improve overall access, but is likely to attract additional traffic volumes to the SODO area.
- Sound Transit ST2 Plan. – There will be an increase in the number of Seattle to Tacoma “Sounder” commuter rail trips across South Holgate Street.
- Alaskan Way Viaduct Replacement. – The bored tunnel under the Central Waterfront will not include direct access to the Seattle Downtown; therefore, there will be a greater reliance upon SODO arterials such as Alaskan Way S, 1st Avenue S, and 4th Avenue S.)

In May, 2009, the Washington State legislature authorized WSDOT to construct a deep bored tunnel to replace the Alaskan Way Viaduct. According to the current schedule, the bored tunnel will be completed by 2016 and surface street improvements along the waterfront will likely be completed in 2017 or 2018.

“Therefore, the focus of this study is to formulate the City’s possible actions after 2018.”

Chapter 2. Prior Plans, Studies and Analyses

ACCESS DUWAMISH

In 1998, the City and Port of Seattle commissioned a partnership project to address access and congestion problems in the North Duwamish area. The project summary report, entitled *Access Duwamish* (June 2000), identified S Holgate Street as a truck route and recommended several key capital improvements to improve freight mobility and access, including SR 519 improvements, Spokane Street Viaduct widening, E Marginal Way/SR 99 ramps and the S Lander Street overcrossing projects. The report concluded that S Holgate Street was not a desirable location for a grade-separated overcrossing because of the engineering challenges involved.

S HOLGATE STREET RAILWAY CROSSING CLOSURE TRAFFIC STUDY (2003)

WSDOT commissioned a study in 2003 to evaluate the traffic-related impacts of closing S Holgate across the railroad tracks. The study analyzed the traffic impacts of the S Holgate Street closure during the AM and PM peak hours on the intersections in the vicinity of S Holgate Street. It concluded that with the closure, these intersections would continue to operate at an acceptable LOS and the potential for train-related collisions on S Holgate Street area would be eliminated. The study recommended that S Holgate Street be fully and permanently closed.

SDOT RESPONSES TO THE WSDOT STUDY CITED ABOVE

In 2004, SDOT made many comments on the 2003 S Holgate Street Railway Closure Traffic Study to WSDOT, some of which are listed below:

- S Holgate Street is an important route in the industrial district. Besides providing connections between heavily used north-south arterials, S Holgate Street provides a direct connection to Beacon Avenue S and the Beacon Hill neighborhood.
- S Holgate Street is a significant east-west freight route through the industrial district. The closure of S Holgate Street could severely impair freight operations.
- The analysis was incomplete because it did not recognize the traffic demand variations in the area for ferry operations and cruise ship traffic, and special events such as baseball and football games.
- The analysis for pedestrians and bike riders was insufficient.
- The City also expressed concerns about traffic impacts of the closure of S Holgate Street on the industrial area during the replacement for Alaskan Way Viaduct.

S HOLGATE STREET RAILWAY CROSSING CLOSURE TRAFFIC IMPACT ANALYSIS (2005)

To respond to the comments received from SDOT, (along with Sound Transit, King County Metro, and the Northwest Region of the Washington State Department of Transportation), the WSDOT Rail Office initiated the *S Holgate Street Railway Crossing Closure Traffic Impact Analysis* study to investigate the short- and long-term traffic impacts that could be caused by the closure of S Holgate Street. The report was issued in January 2005. This study also recommended that S Holgate Street should be closed to traffic at the railroad crossing based on the following reasons:

- The capacity of S Holgate Street would be significantly reduced with additional train traffic, such that vehicles would seek alternative routings with or without the closure.
- Extensive queuing resulting from crossing closures could impact traffic flow at other intersections.
- Anticipated expansion of the track area would make it difficult to control vehicle and pedestrian traffic.

S HOLGATE STREET RAILWAY CROSSING CLOSURE TRAFFIC IMPACT ANALYSIS – ADDENDUM NO. 1

WSDOT issued an addendum report in May 2005 to address the issues raised by City of Seattle staff on the initial report. The SDOT staff had expressed concerns that the 2005 report did not fully address all the comments that the SDOT staff had previously raised. The Addendum report included the following responses:

- Traffic volumes used in the initial report: SDOT staff had indicated that the traffic volumes used in the 2005 report appeared too low – the Addendum concluded that these volumes were accurate.
- Adjustments to the ferry traffic volumes – the Addendum stated that the closure of S Holgate Street would not have a measureable impact on ferry traffic.
- Cruise ship traffic – The Addendum concluded that traffic for cruise ships occurs on weekends and would not impact the weekday peak hour traffic. This report maintained a focus on the PM peak hour as the time period to evaluate the impact of the S Holgate Street closure.
- A comparison of the traffic forecast for the 2030 Alaskan Way Viaduct with the forecast for the S Holgate Closure Study concluded that the 2030 volumes from both studies were comparable. The Addendum did not address the City's comment regarding the construction traffic related to the Alaskan Way Viaduct replacement.
- Special events – the Addendum acknowledged that the closure of S Holgate Street would eliminate a major east-west crossing of the railroad during special events.

TRAFFIC IMPACT ANALYSIS ON S HOLGATE STREET AND S ROYAL BROUGHAM WAY CLOSURES

In 2005, SDOT asked Fehr & Peers (then Mirai Associates) to analyze the traffic impacts from closing S Holgate and other streets - focusing on the PM peak hour, event peak hour (Mariners ballgame on a weekday) and Alaskan Way Viaduct construction. This study recommended the following:

- S Holgate Street and Royal Brougham Way should remain open for traffic through the duration of the Alaskan Way Viaduct and Seawall Replacement Project.
- Identify near-term improvements that would increase railroad and traffic safety, and efficiency.
- Continue to develop alternatives for long-term improvements.

RELEVANT LARGE-SCALE CAPITAL PROJECTS

PREFERRED SR 519 PHASE II OPTION

In 2004, WSDOT completed Phase I of the SR 519 project consisting of a S Atlantic Street railroad overpass and a new eastbound on-ramp from S Atlantic Street to I-5 and I-90. The original plan, envisioned in 1997, was to have two parallel overpasses above the railroad tracks with the eastbound crossing on S Atlantic Street and the westbound crossing on S Royal Brougham Way. However, with the opening of Safeco Field in 1999 and Qwest Field in 2002, the affected agencies and Stadium District decided that the original SR 519 plan would required modification. In 2006, WSDOT, the City of Seattle and Port of Seattle announced the preferred SR 519 Phase II option, which included:

- New westbound off-ramp to S Atlantic Street from I-90.
- New S Royal Brougham Way railroad overpass connecting 3rd Avenue S to Occidental Avenue S along with a two-lane elevated arterial with bicycle lanes and an elevated pedestrian walkway.
- Improvements to the intersection of S Atlantic Street, east of 1st Avenue S.

Appendix F provides a sketch of the SR 519 phase II and a more detailed project description.

ALASKAN WAY VIADUCT

In early 2009, Washington Governor Chris Gregoire, King County Executive Ron Sims and Seattle Mayor Greg Nickels recommended that the Alaskan Way Viaduct along Seattle's Central Waterfront be replaced with a bored tunnel through downtown Seattle. The recommendation also included a new waterfront surface street, transit investments, and downtown waterfront and city street improvements. The 2009 state legislature approved funding to construct the state share of the Alaskan Way Viaduct project. According to the current schedule, the environmental review and preliminary design will be completed by the end of 2010 of 2nd quarter, 2011 and the construction of the tunnel by the end of 2016. The surface Alaskan Way improvements and waterfront promenade construction are anticipated to be completed in 2018.

As noted earlier, based on recommendations made to SDOT by Fehr & Peers (then Mirai Associates), SDOT advised Amtrak and WSDOT that S Holgate Street would not be closed for traffic operations while the Alaskan Way Viaduct was under construction. SDOT indicated that an additional study would be needed to evaluate whether it would be closed after the Alaskan Way Viaduct project was completed.

LONG-RANGE FACILITY IMPROVEMENT PLANS

BURLINGTON NORTHERN SANTA FE RAILROAD (BNSF)

BNSF staff indicated that they did not have a long-range facility plan given the market-driven nature of their business model. BNSF owns the tracks that are used by Amtrak, WSDOT and Sound Transit. For the freight operations, the national and local economies influence the length of each train and the frequency of the freight trains. BNSF has stated that it would be difficult to forecast the duration of time or frequencies of the train gate closures on S Holgate Street.

SOUND TRANSIT

On November 4, 2008, voters of the Central Puget Sound region approved the Sound Transit 2 (ST2) Plan. Through the ST2 Plan, Sound Transit will expand the commuter rail (Sounder) service and increase capacity by adding trains and expanding the length of the trains. Four round trips will be added to the segment between Tacoma and Downtown Seattle; adding to the eight round trips that are provided today. The ST2 Plan includes funds for constructing and operating a commuter rail yard and shop facility to support the level of service for Sounder trains at full operational capacity.

WSDOT AMTRAK CASCADES

The Washington State Department of Transportation (WSDOT) initiated an intercity passenger rail service called *Amtrak Cascades* in 1993. In the following year, WSDOT leased a Spanish-built Talgo train and provided two round trips between Seattle and Portland. Currently, Amtrak Cascades includes four round trips between Seattle and Portland, two of which serve Eugene, and three round trips between Seattle and Bellingham, one of which extends to Vancouver, BC.

A 2006 report entitled the *Long-Range Plan for Amtrak Cascades* indicated that by 2023, the goal is to provide 13 round trips between Seattle and Portland, and 4 round trips between Seattle and Vancouver BC. The current maximum authorized train speed is 79 miles per hour along the entire corridor. This plan assumed that the maximum train speeds would increase up to 110 miles per hour, reducing the travel time between Seattle and Portland by one hour. It also assumed that the reduced travel times would attract more riders. The plan projects that by 2023 ridership would increase by 2.5 million to about 3 million riders in the Vancouver-Seattle-Portland corridor.

AMTRAK MAINTENANCE FACILITY

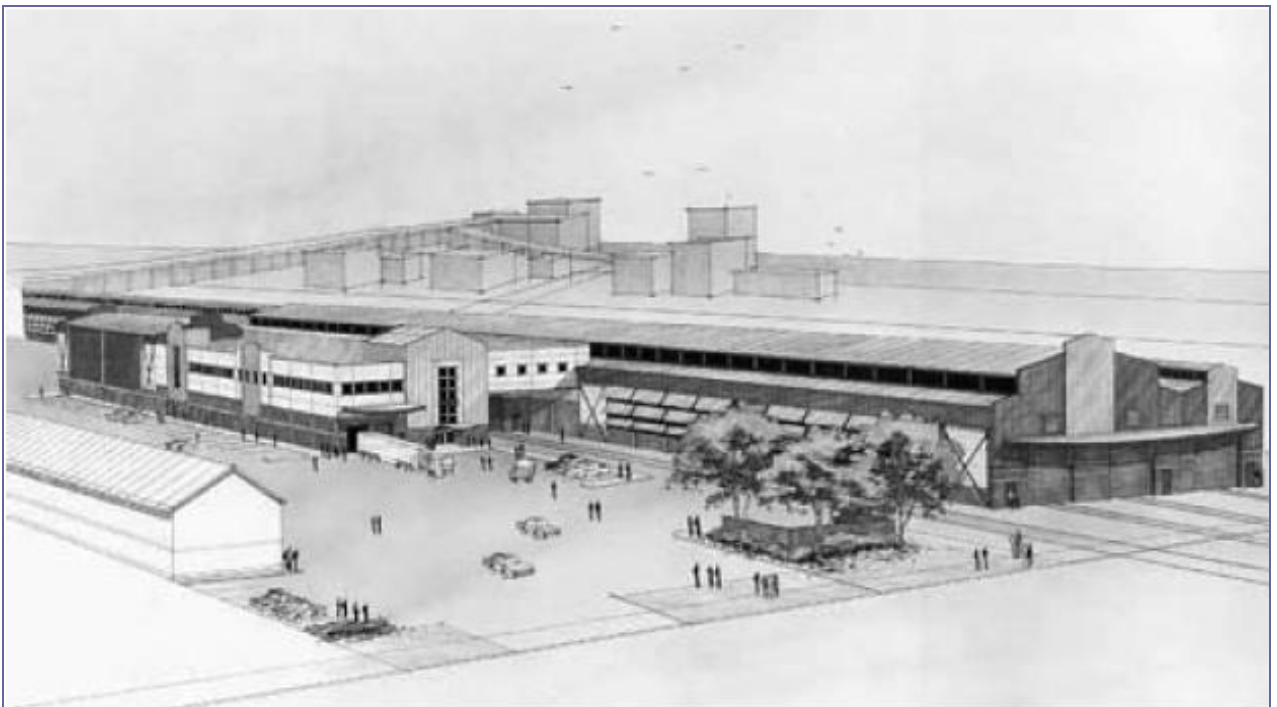
A new Amtrak maintenance facility has been planned for the area from near Safeco Field to both sides of S Holgate Street. Construction is being undertaken in phases. Phase I, completed in 2002, included a rail car washer and a wheel maintenance building. Phase II, completed in 2008, relocated the mainline tracks to the east along 3rd Avenue NE. The final two phases are as of yet unfunded and include a primary maintenance and repair site on both sides of S Holgate Street for Amtrak and Sounder commuter rail. In fact, Amtrak is

considering a consolidation of much of its entire West Coast maintenance operations at this new facility.

Amtrak's consistent position has been that a full closure of S Holgate Street would achieve the following:

- Increase safety for its employees currently crossing S Holgate Street to get from one end of the maintenance facility to the other.
- Eliminate opportunity for collisions between trains and vehicles, pedestrians, and bicyclists crossing the tracks.
- Improve the overall efficiency of maintenance operations, now and in the future.
- Enable Amtrak to more fully secure its facilities and reduce the threat from vandalism, theft and terrorism.

An artist's rendering of the maintenance facility in the King Street Station area.



Source: Washington State Long-Range Plan for Amtrak Cascades, WSDOT, February 2006.

Chapter 3. S Holgate Railroad Crossing Survey Analysis and Results

In 2008, SDOT asked Fehr & Peers to identify and prioritize key short-term (2015) and long-term (2030) transportation needs and improvements in the study area related to the railroad lines across S Holgate Street. The S Holgate Railroad Crossing Study Phase II was initiated. The Phase II study area is identical to the Phase I study and is generally referred to as the South Downtown (SODO) area, which is bounded by Jackson Street in the north, I-5 in the east, S Spokane Street in the south, and Elliott Bay in the west. The study area is shown in **Figure 1**.

This chapter summarizes technical analyses that provide answers to the following questions:

1. Have the daily train volumes increased over the last several years?
2. What is the duration of time that the train gates are down on S Holgate Street?
3. Do the train gate closures vary by time of day?
4. How many pedestrians and bicycle use S Holgate Street crossing the railroad tracks?
5. The train operators are responsible for what percentage of the gate closures?

HISTORICAL MAINLINE TRAIN VOLUMES

BNSF staff provided historical mainline train volume data at the S Holgate railroad crossing. The data included freight train and passenger train volumes per day. The passenger train volumes included Sound Transit commuter rail and those operated by Amtrak. It appears that the freight volumes peaked in 2005 and 2006 and decreased in 2007 and 2008, while the passenger train volumes increased from 12 per day in 2004 to 18 per day in 2008 as shown in **Table 1**.

Table 1. Daily Mainline Train Counts for Freight and Passenger Services

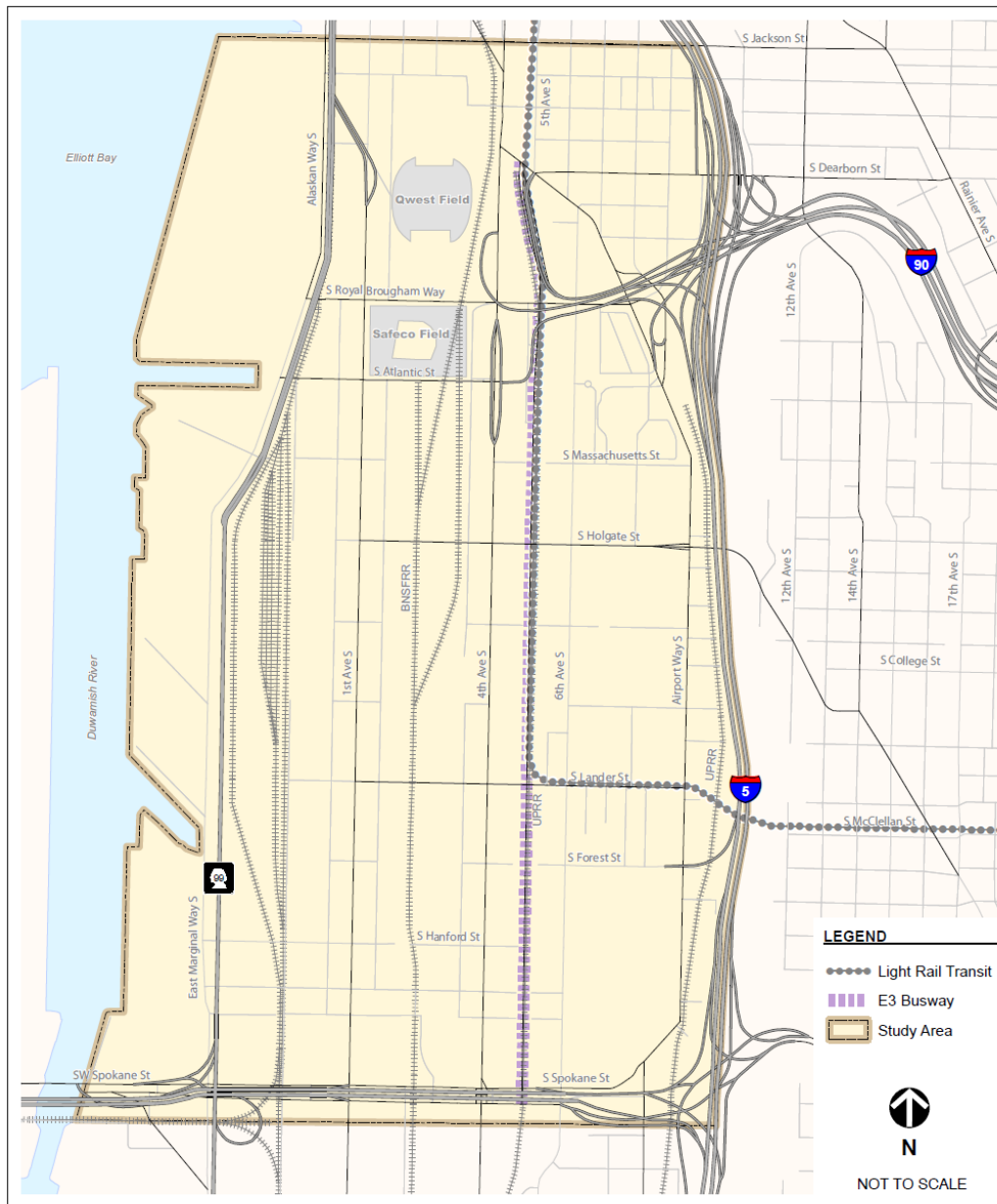
Daily Mainline Train Counts			
	Freight	Passenger	Total
2004	43	12	55
2005	51	12	63
2006	51	15	66
2007	43	16	59
2008	42	18	60 (67*)

* This number was provided for December 2008

Source: BNSF

Chapter 3. South Holgate Railroad Crossing Survey Analysis and Results

Figure 1. S Holgate Street Railroad Crossing Study Area



COMPARISON OF ACTUAL MAINLINE TRAIN VOLUMES WITH PRIOR STUDY FORECASTS

The previous studies commissioned by WSDOT forecast increases in train volumes. It appears that the WSDOT forecasts were for freight and passenger trains using the mainline tracks. **Table 2** compares the actual mainline train volumes provided by BNSF with the forecast in the WSDOT report issued in 2005.

The WSDOT report indicated that 65 trains per day crossed S Holgate Street in 2004. However, BNSF recorded that the actual average train volume was 55 for that year, a difference of 10 trains. The WSDOT forecast of train volumes for 2007 and 2027 show a significant increase: 115 trains in 2007 and 234 trains in 2027. BNSF data showed that from 2004 to 2007, there was only an increase of 4 trains while the WSDOT study forecast an increase of 50 trains in the same 3-year period.

In addition to BNSF, we contacted Amtrak and Sound Transit to obtain future train volume forecasts. Neither agency could provide the long-term train volume forecasts that are comparable to the WSDOT 2027 forecast².

Table 2. Comparison of Mainline Train Volumes per Day

	Mainline Train Volumes Per Day	
	WSDOT Report	Actual (BNSF)
2004	65	55
2007	115 (Forecast)	59
2008		60
2027	234 (Forecast)	

Source: WSDOT and BNSF

COMPARISON OF CLOSURE TIMES FORECAST BY WSDOT

The 2005 WSDOT funded studies indicated that the average train gate closure time in 2004 ranged 8.1 to 8.8 minutes per hour, as shown in **Table 3**³. In 2009, Fehr and Peers, with the assistance of SDOT Traffic Management staff, continuously video-taped the train movements and gate closures for a week in January. Table 3 also shows the 2009 weekday actual gate closure times based on the video recordings.

The WSDOT report showed the forecast for the gate closure time on S Holgate Street for 2007 and 2027. The forecasts showed that in 2007 the gate would be closed for 23 to 24 minutes during the AM and PM peak hours, and for 12 minutes during the off peak hours.

However, the 2009 video survey showed that the actual AM and PM peak hour closure times were 11 to 12 minutes, or *half* of the earlier WSDOT forecast for 2007. Note that the prior off-peak hour forecast for 2007 is almost same as the 2009 actual. This table appears to show that the prior forecasts for 2007 assumed much higher train volumes for AM and PM peak

² We could not find any description that shows how the 2007 and 2027 WSDOT forecasts were developed.

³ The WSDOT report failed to explain how the gate closure times were obtained.

hours than actually occurred. The earlier report does not provide information about how those forecasts were prepared and what assumptions were used. Therefore, it is not possible to assess whether the 2027 forecasts were fully valid or accurate. For example, the 2007 forecasts for AM and PM peak hour train gate closure times deviate 100 percent from the 2009 actual closure times as demonstrated by the video monitoring.

Table 3. Hourly and Average Train Gate Closure Times (Actual, 2004 and 2009 Data and 2007 and 2027 Forecasts)

	WSDOT Report			2009 Weekday Actual
	2004	2007 Forecast	2027 Forecast	
AM Peak Hour	8.2 min	24 min	46 min	11.9 min
PM Peak Hour	8.1 min	23 min	42 min	11.1 min
Off Peak Hour	8.8 min	12 min	20 min	12.5 min

Source: WSDOT (2004, 2007, and 2021) and Fehr & Peers (2009)

PEDESTRIANS AND BICYCLISTS CROSSING RAILROAD TRACKS (EAST-WEST)

The City of Seattle has a traffic camera located in the vicinity of the 1st Avenue S and S Holgate Street intersection. As we described earlier, the City video recorded the railroad crossing of S Holgate Street on a video for a week in January 2009. Specifically, on January 15, 2009, we counted pedestrians and bicycle riders who crossed the railroad tracks for the 24-hour period. We combined the pedestrian and bike counts for each hour and plotted the hourly volumes in **Figure 2**. Based on the video, pedestrians were present from the early morning to the late night hours. The pedestrian volumes peaked three times: 8 to 9 AM in the morning, 1 to 2 PM in the midday and 4 to 5 PM in the evening. About 50 people during the 4 to 5 PM period walked on S Holgate Street and crossed the railroad tracks. During the day, a total of 330 pedestrians and 50 bicyclists walked/rode on S Holgate Street and crossed the railroad tracks. Anecdotal evidence suggested these were area employees, bus riders seeking transfers, and patients from a nearby outpatient medical clinic.

PEDESTRIANS CROSSING S. HOLGATE STREET (NORTH-SOUTH)

In addition to the pedestrians and bikes traveling on S Holgate Street, about 350 other people crossed S Holgate Street along the railroad tracks in the north-south direction. They appeared to be the railroad workers. The hourly volumes of pedestrians crossing in the S Holgate Street area are shown in **Figure 3**. This pattern of pedestrians crossing S Holgate Street is quite different from the pedestrians walking along S Holgate Street and crossing the railroad tracks, in that there was one clearly defined peak hour from 2 to 3 PM.

Figure 2. Pedestrians and Bicyclists on S Holgate Crossing the Railroad Tracks (East-West Movements)

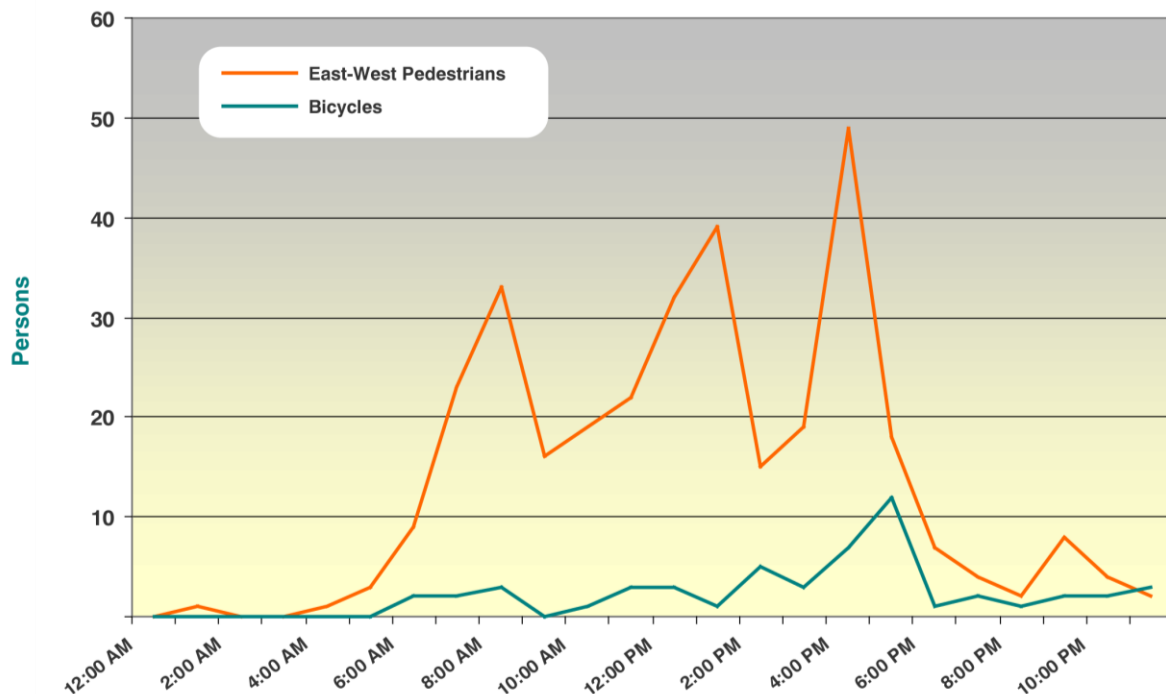
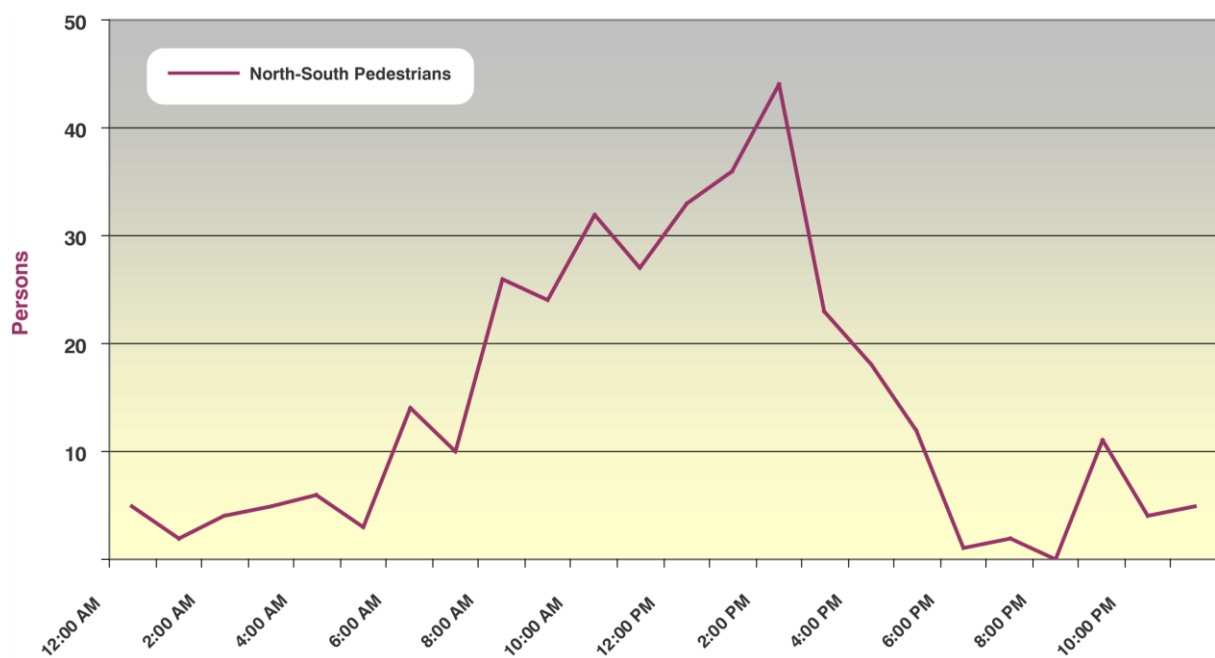


Figure 3. Pedestrians Crossing S Holgate Street (North-South Movements)



Source Figures 3 and 4: Fehr & Peers (2009)

SIDEWALK CONDITIONS

The aerial photo (**Figure 4**) shows the roadway and sidewalks along S Holgate Street between 1st Avenue S and 4th Avenue S, and the new mainline train track crossings near 3rd Avenue S. Sidewalks are provided on S Holgate Street between 3rd and 4th Avenues S, and between 1st Avenue S and Occidental Avenue S, as well as a short section on the north side where the old mainline train tracks cross S Holgate Street. There is no sidewalk on the south side between Occidental Avenue S and 3rd Avenue S where pedestrians walk either on the edge of the pavement or on the roadway surface.

Figure 4. Sidewalks on S Holgate Street between 1st Avenue South and 4th Avenue South



Source: Fehr & Peers

AVERAGE TIME PER GATE CLOSURE

As described earlier, SDOT recorded the traffic and train movements at the S Holgate Street railroad crossing for a week, from January 12 to 19, 2009. We found that the railroad gates on S Holgate Street closed an average of 112 times per day during the weekdays and 79 times during the weekends. During the weekday, the total time that the gates were closed to stop traffic was 4 hours and 50 minutes per day, about 20 percent of 24 hours. During the weekend, the gates were closed for 3 hours and 25 minutes, about 14 percent of the day.

Figure 5 summarizes of the average minutes per gate closure during the weekday. The average time per gate closure was 2.5 minutes. The figure also shows the average closure time per gate closure by five time periods: AM peak period, midday period, PM peak period, evening period and night periods. We found that in the evening and night periods the average time of each gate closure was longer, about 3 to 3.5 minutes.

AVERAGE TIME OF GATE CLOSURE PER HOUR

For weekdays, the average minutes per hour the gate was closed was 12 minutes as shown in **Figure 6**. The average closure time per hour during the evening period (6 to 10 PM) was 17 minutes, significantly higher than the 24-hour average, and the night AM (12 to 6 AM) period was about 7 minutes, lower than the daily average. Throughout the AM peak, midday and PM peak periods, the average gate closed time per hour was relatively constant - 11 to 12 minutes per hour. It should be noted that we observed several times during the recorded week when the gate was closed for more than 30 minutes.

Figure 5. Average Time of Each Railroad Gate Closure (Weekday)

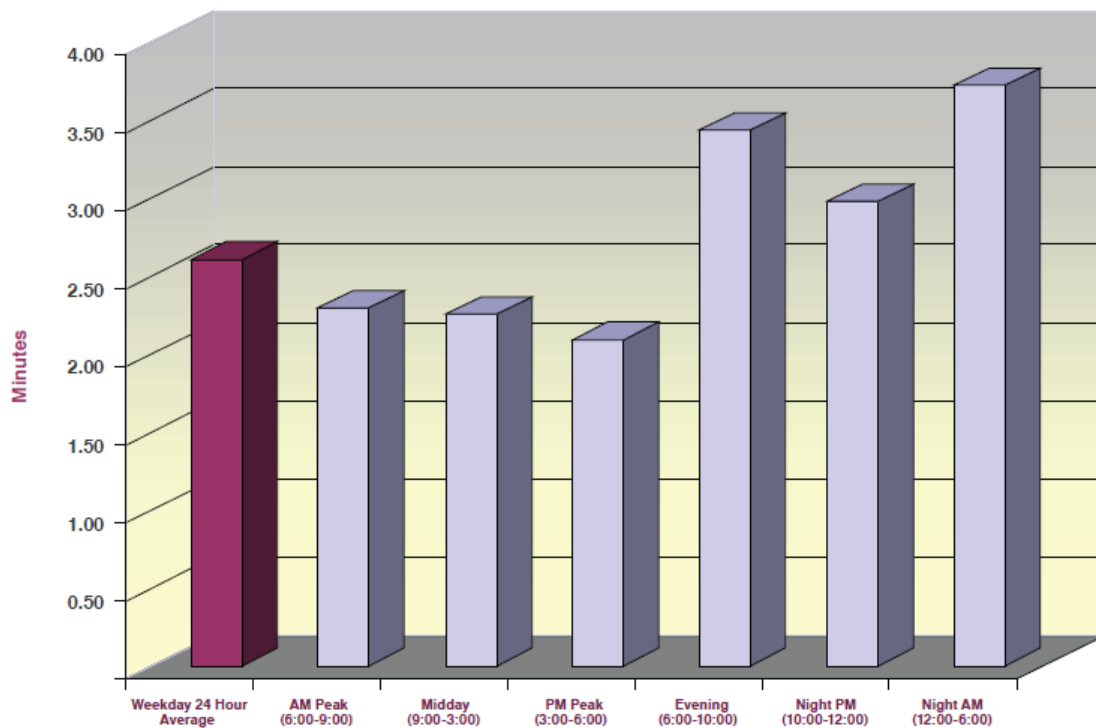
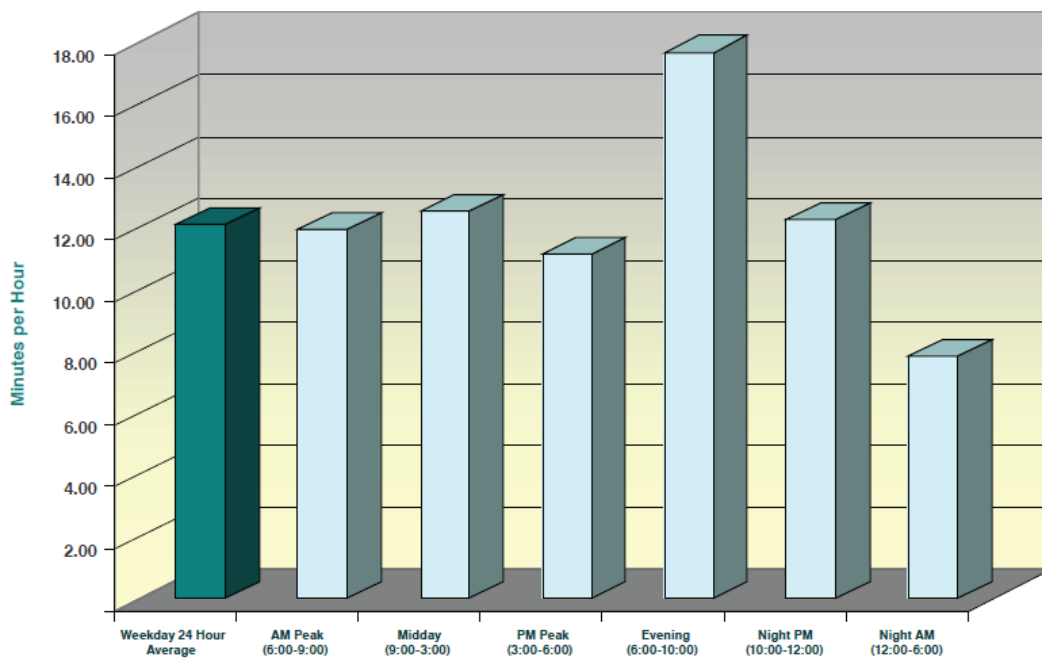


Figure 6. Average Time of Gate Closure in Minutes per Hour



Source for Figures 5 and 6: Fehr & Peers (2009)

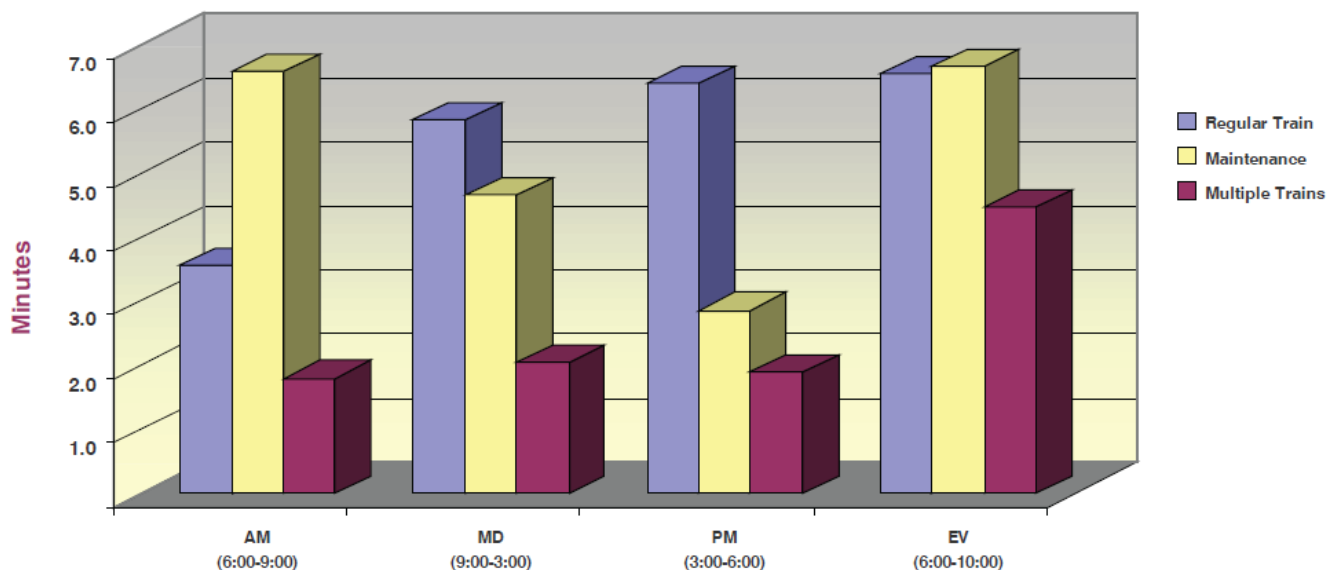
TIME OF GATE CLOSURES BY TYPE OF TRAIN OPERATION

When Fehr & Peers observed a gate closure and a train crossing S Holgate Street a judgment was made about the type of the train; in terms of the train being either a “regular train” (i.e. train moving quickly across S Holgate Street) or a “maintenance train” (i.e. train moving slowly often back and forth). The regular trains appeared to be long-haul trains and used the mainline tracks. We employed the label “maintenance train” if we saw a 1 to 3 car freight train or an engine only; a train involved in what appeared to be switching activities or lowered gates without train crossings. Finally, “multiple trains” is our term for two sets of trains crossing S Holgate Street simultaneously.

Figure 7 shows the train gate closure time in minutes per hour separated by the type of the train operations: regular train, maintenance train, or multiple trains for the four time periods. During the AM peak period, the majority of the gate closure time is caused by maintenance trains. The condition is reversed in the PM peak period when regular train activities closed the gate for longer periods than the maintenance train activities.

On an average weekday, 51 percent of the gate closure time was caused by regular train operations, 38 percent by maintenance operations, and 11 percent by multiple trains. In summary, more than one-third of the gate closure time occurs because of maintenance operations. This is a significant finding because the previous studies did not discuss gate closures caused by the maintenance train operations.

Figure 7. Time of Gate Closures by Type of Train Operation



Source: Fehr & Peers (2009)

TIME AND PERCENT OF GATE CLOSURES BY TRAIN OPERATOR

Using the video recording, Fehr & Peers identified the operators of the trains when the gates came down - Amtrak, Sound Transit Sounder, or BNSF. We assumed that all freight trains were operated by BNSF. In some cases, multiple trains crossed S Holgate Street at the same time and we could not single out one operator, so we labeled this situation as "Multiple Trains". Also, there were cases when the gates moved down and up without a train passing by. In this case, we labeled it as "No Train". **Table 4** shows the total time and percent of gates that are closed by train operator during the 24-hours on Thursday, January 15, 2009. About 59 percent of the gate closure time was due to the freight trains operated by BNSF. Amtrak passenger trains, including the trains funded by WSDOT, were responsible for about 14 percent of the closure time; and Sounder commuter rail trains were responsible for 16 percent of the total closure time. Please note that the gate closure time included all train operational activities, such as, mainline movements that included scheduled passenger services, switching, and any other maintenance activities that used other tracks than the mainlines.

Table 4. Gate Closure Times by Train Operators During Average Weekday

Train Operator	Time of Gates Closed for Traffic (hour: min)	Percent of Time Gates Closed for Traffic
Amtrak	0:42	14.3%
Sound Transit (Sounder)	0:48	16.4%
BNSF (Freight)	2:52	58.7%
Multiple Trains	0:20	6.8%
No Train	0:11	3.9%
Total	4:53	100.00%
Note: Trains were observed Thursday January 15, 2009		

Source: Fehr & Peers

Chapter 3. South Holgate Railroad Crossing Survey Analysis and Results



Chapter 4. Existing and Future Traffic Analysis

This chapter reviews the existing traffic conditions and summarizes the future traffic conditions with and without S Holgate Street. Some of the questions that are addressed in this chapter are:

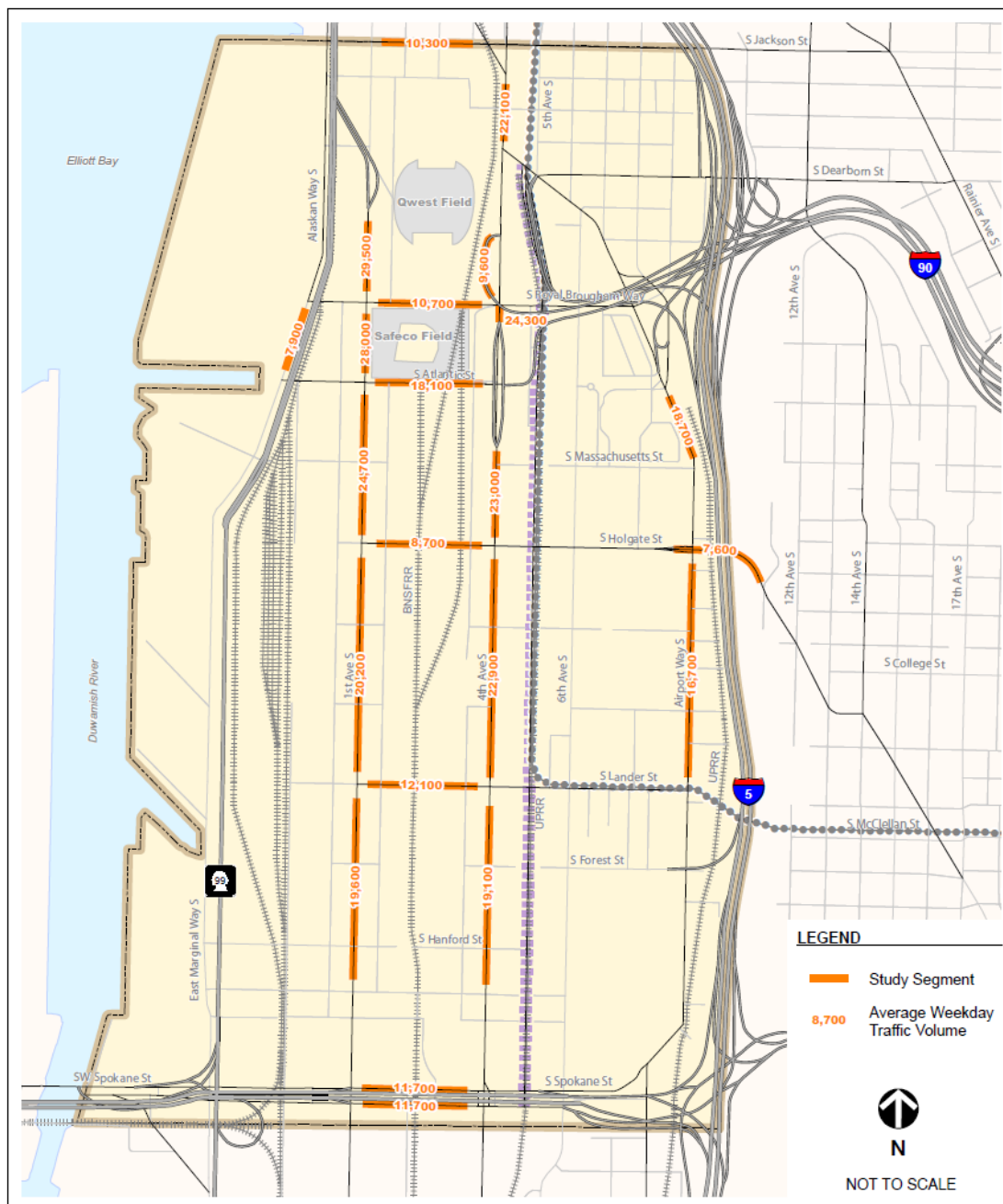
- Did the traffic volumes on S Holgate Street increase over the last several years?
- Does S Holgate Street carry a large number of trucks?
- Would there be significant changes to traffic volumes on S Holgate Street on a baseball game day?
- What would intersection levels of service be in 2015 and 2030 with or without S Holgate Street?

DAILY TRAFFIC VOLUMES

The City of Seattle regularly collects daily traffic counts on arterial streets city-wide. When Fehr & Peers (Mirai Associates) conducted the Phase I study, we conducted extensive AM and PM peak period traffic counts. The Phase I study created a composite daily traffic count map showing 2005 to 2006 conditions using available daily traffic count data, which is shown in **Figure 8**. Both 1st Avenue S and 4th Avenue S are major arterials, each carrying over 20,000 vehicles per day in the vicinity of S Holgate Street. S Holgate Street itself carried 8,700 vehicles per day in 2005 to 2006.

[Note that S Holgate Street currently carries over 12,000 vehicles per day (SDOT, 2008). This change will be discussed at the next section, the Daily Traffic Volume Trend.]

Figure 8. Daily Traffic Volumes in 2005 – 2006



DAILY TRAFFIC VOLUME TRENDS

Based on the traffic counts provided by SDOT, the daily traffic volumes from 2000 to 2008 at three locations were plotted. These locations are:

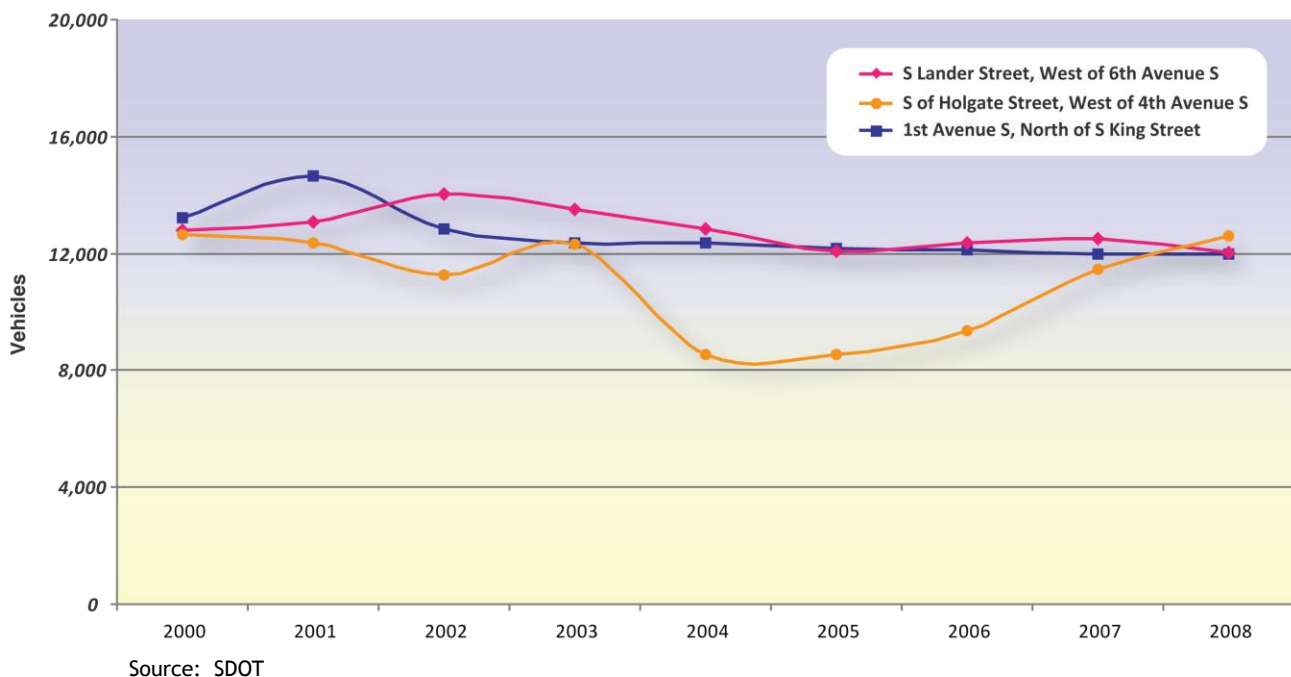
- S Holgate Street west of 4th Avenue S
- S Lander Street west of 6th Avenue S
- 1st Avenue S north of S King Street (This location is just north of the study area.)

Figure 9 shows the daily traffic volume change trends. In 2000, the traffic volume on S Holgate Street was about 12,000 vehicles per day (vpd). The volumes declined significantly from 2003 to 2004, to about 8,000 vpd. Since 2005, the S Holgate Street traffic volumes have gradually increased reaching the 2000 level in 2008, which was about 12,000 vpd.

S Lander Street has been carrying the same amount of traffic since 2002, about 12,000 vehicles per day. The traffic volumes on 1st Avenue S north of King Street have declined from 2002 to 2004. However, these volumes have been steady since 2005 with about 12,000 vehicles per day.

It is difficult to find the exact cause of the traffic volume decline in 2004. The most reasonable explanation is that about 20 to 25 percent of the traffic on S Holgate Street shifted to S Atlantic Street when the SR 519 Phase I project was completed. Over the last few years as S Atlantic Street got more congested, the shifted traffic moved back to S Holgate Street.

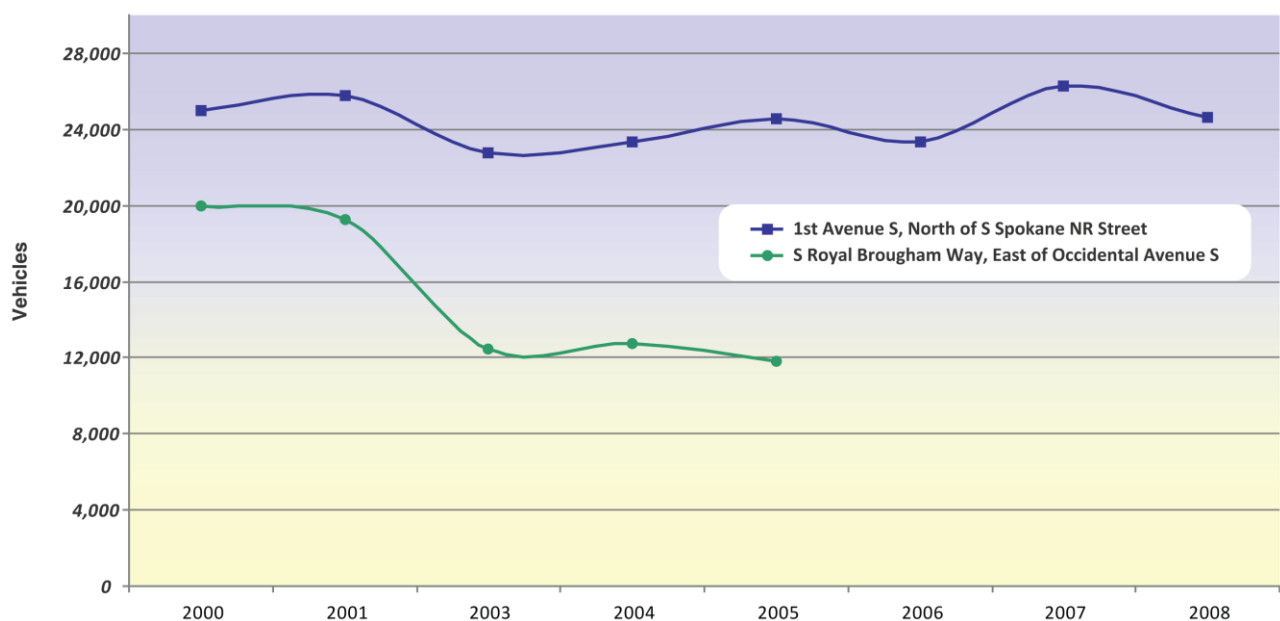
Figure 9. Daily Traffic Volume Trends on S Lander Street, S Holgate Street and 1st Avenue S (2000 to 2008)



The historical daily volumes of S Royal Brougham Way east of Occidental Avenue S and 1st Avenue S north of S Spokane Street were also plotted, however, the counts on S Royal Brougham Way are available from only 2000 to 2005. As shown in **Figure 10**, traffic volumes on S Royal Brougham Way dropped significantly from 2001 to 2003, and remained at the 2003 level until 2005. Although it is not clear why this change occurred, it may be related to a shift of traffic to S Atlantic Street due to the new elevated structure over the railroad tracks and the opening of 4th Avenue S.

The traffic volumes on 1st Avenue S in the vicinity of Spokane Street have fluctuated between 23,000 to 26,000 vehicles per day during the last 8 years. However, no significant traffic volume increases have occurred during this time.

Figure 10. Daily Traffic Volumes on S Royal Brougham Way and 1st Avenue S (2000 to 2008)



Source: SDOT

TRUCK VOLUMES ON S HOLGATE STREET

The type of the vehicles traveling on S Holgate Street in 2005 is shown in **Table 5**. About 2 percent of the total vehicles that used S Holgate Street were heavy trucks, which we have defined as vehicles with multiple units and some single unit vehicles with three or more axels. Light trucks comprised about 21 percent of the total.

We also plotted hourly volumes showing light trucks and heavy trucks separated from all other vehicles in **Figure 11**. The overall PM peak hour occurs between 3 and 4 PM. However, the peak hour for truck traffic is in late morning between 11 AM and 12 PM. **Table 5** demonstrates that S Holgate Street is an important roadway for a significant volume of commercial vehicles.

Table 5. Daily Truck Volumes on S Holgate Street by Type of Vehicle (2008)

Vehicle Type	Volumes per Day	Percent
Trucks*	250	2.10%
Light Trucks**	2,500	21.10%
Passenger Cars	7,800	65.30%
Others***	1,400	11.50%
Total	11,950	100.00%

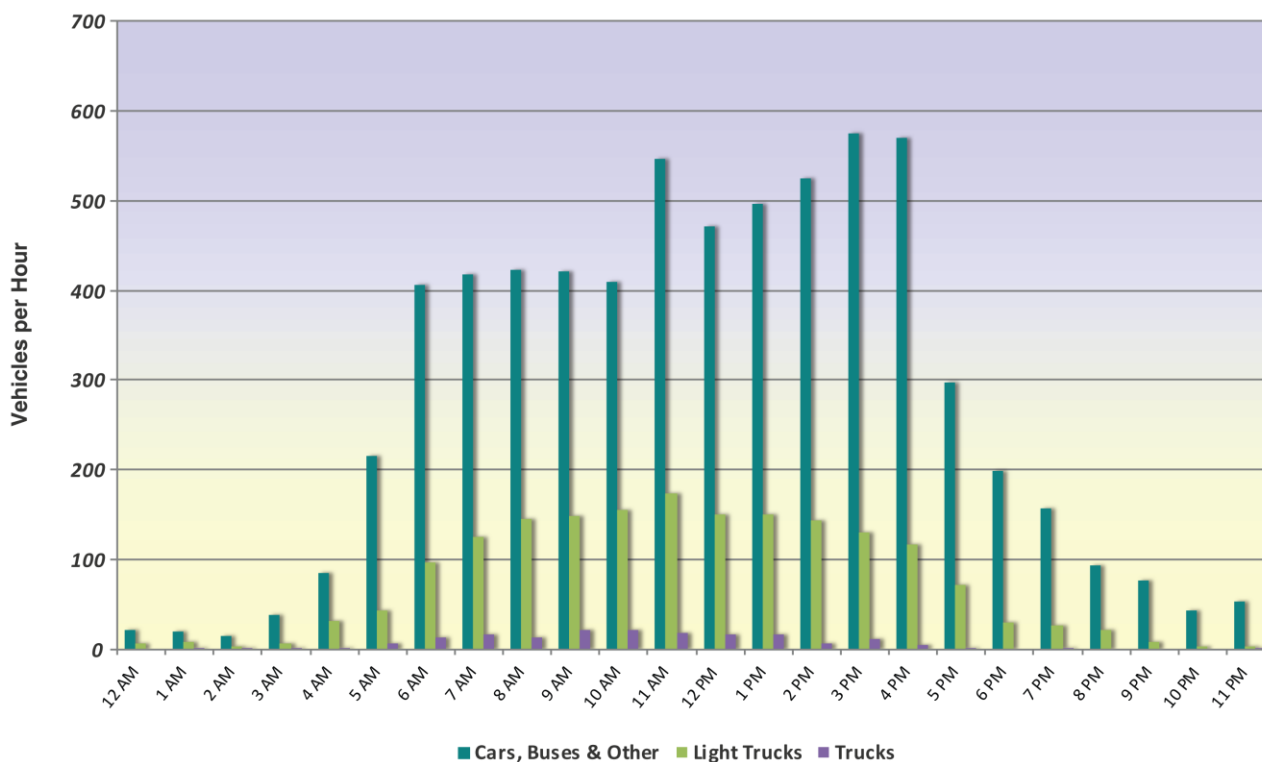
* Trucks are understood to be multiple unit vehicles (trailer trucks) and single-unit vehicles with 3 and 4 axels.

** Light Trucks are single unit, two-axle trucks with four or six tires.

*** Others include buses, motor cycles and vehicles that could not be classified.

Source: Fehr & Peers

Figure 11. Traffic Volumes Plotted by Hour and by Type of Vehicle



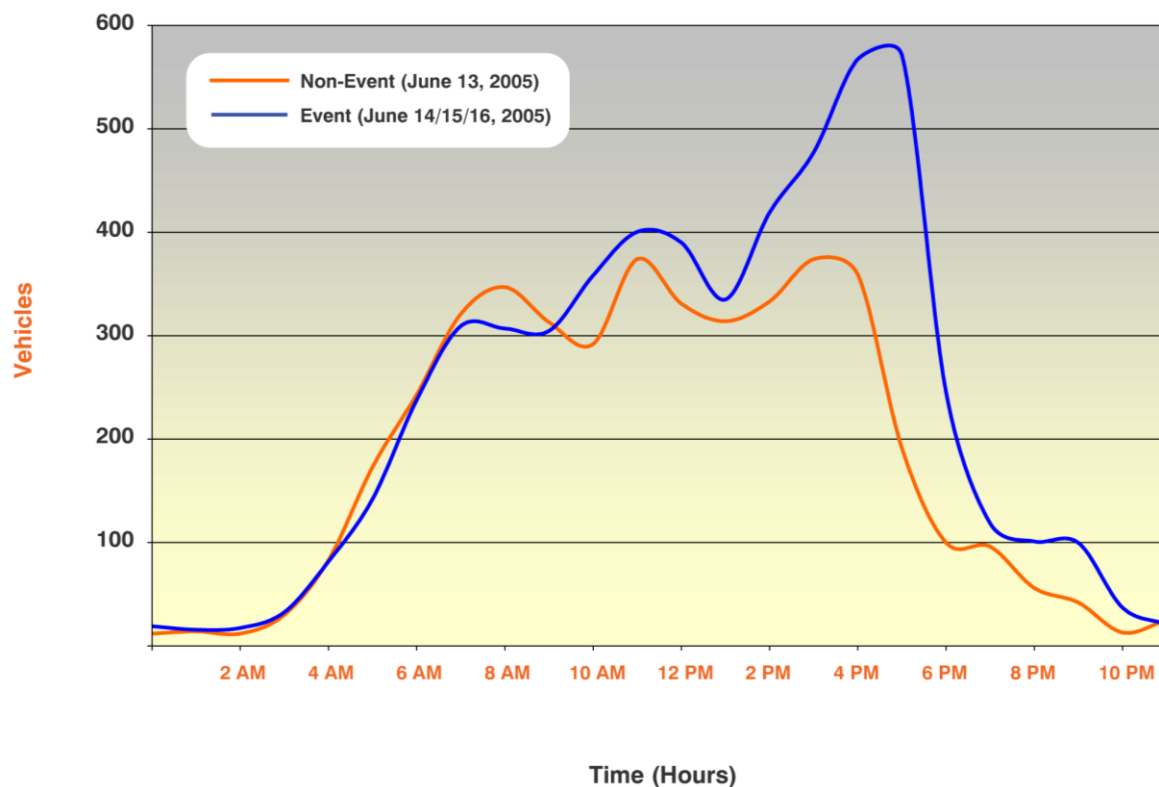
Source: Fehr & Peers

BALLGAME DAY TRAFFIC

A baseball event at the Safeco Field generates a significant amount of traffic in the SODO area. We obtained traffic counts for a ballgame day with a 7 PM game start time. The hourly westbound and eastbound traffic volumes on S Holgate Street were plotted with and without a ballgame as shown in **Figures 12** (westbound) and **13** (eastbound). In the westbound direction, S Holgate Street carried a significantly higher volume of traffic between 2 and 6 PM on the ballgame day compared to a non-ballgame day. This corresponds to visitors entering the stadium from the East.

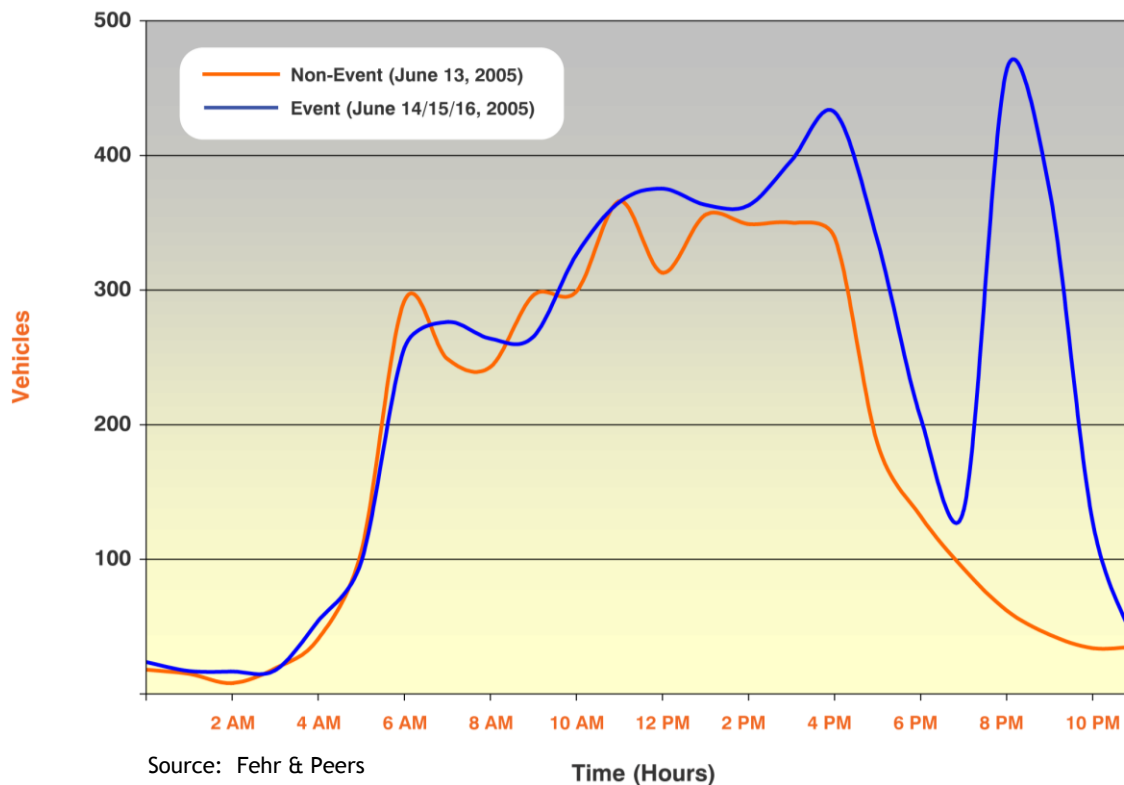
In the eastbound direction on S Holgate Street, the traffic volumes during 4 to 6 PM were slightly higher on a ballgame day, but the difference was less pronounced than the westbound direction. However, after the ballgame, a significant amount of traffic used S Holgate Street in the eastbound direction. The post ballgame traffic on S Holgate Street is highly peaked, which corresponds to the large volume of exiting traffic after the game. These figures show that S Holgate Street plays an important role in providing capacity to accommodate the traffic increase due to the baseball event. Since the traffic movements on the streets surrounding Safeco Field are restricted and the roadway capacity for traffic is not fully utilized due to heavy pedestrian traffic, there is no reasonable alternative roadway corridor that could accommodate the traffic of S Holgate Street, if it were to be closed.

Figure 12. Westbound Traffic Volumes on Holgate Street between 1st Avenue South and 4th Avenue South



Source: Fehr & Peers

Figure 13. Eastbound Holgate Street between 1st Avenue S and 4th Avenue S



EXISTING LEVELS OF SERVICE (LOS)

The 2007 PM peak hour volumes on non-game days were used to calculate the level of service (LOS) at all signalized and several unsignalized intersections in the study area. **Figure 14** shows these intersections and their LOS. Traffic operations for the area surrounded by S Royal Brougham Way, 4th Avenue S, S Holgate Street and 1st Avenue S were simulated with SimTraffic; intersections outside this area were calculated with Synchro. The LOS analysis indicates poor traffic operations along S Royal Brougham Way, with intersections on 1st Avenue S and Occidental Avenue S between S Atlantic Street and S Massachusetts Street operating at LOS E or F. All other study intersections, including those on S Holgate Street operate well, with LOS D or better conditions.

TRAVEL PATTERN OF VEHICLES ON S HOLGATE STREET

Using the Seattle Travel Demand Forecasting model, the travel distribution of the vehicles using S Holgate Street were identified. **Figure 15** shows the westbound distribution pattern of the PM peak period traffic on S Holgate Street between Occidental Avenue S and 3rd Avenue S as 100 percent. Please note that this graphic does not show the traffic movements that go to or from driveways. The figure indicates that 38 percent of the vehicles traveling on S Holgate Street between 3rd Avenue S and Occidental Avenue come from Beacon Avenue S and that 34 percent go to the Alaskan Way Viaduct. This travel pattern shows that S Holgate Street serves as a major connector between the Beacon Hill area east of I-5 and the Seattle Central Waterfront and Alaskan Way Viaduct. The traffic distribution pattern of the eastbound vehicles, shown in **Figure 16**, is very similar to the westbound direction.

Figure 14. Existing Intersection LOS on Weekdays without a Baseball Game

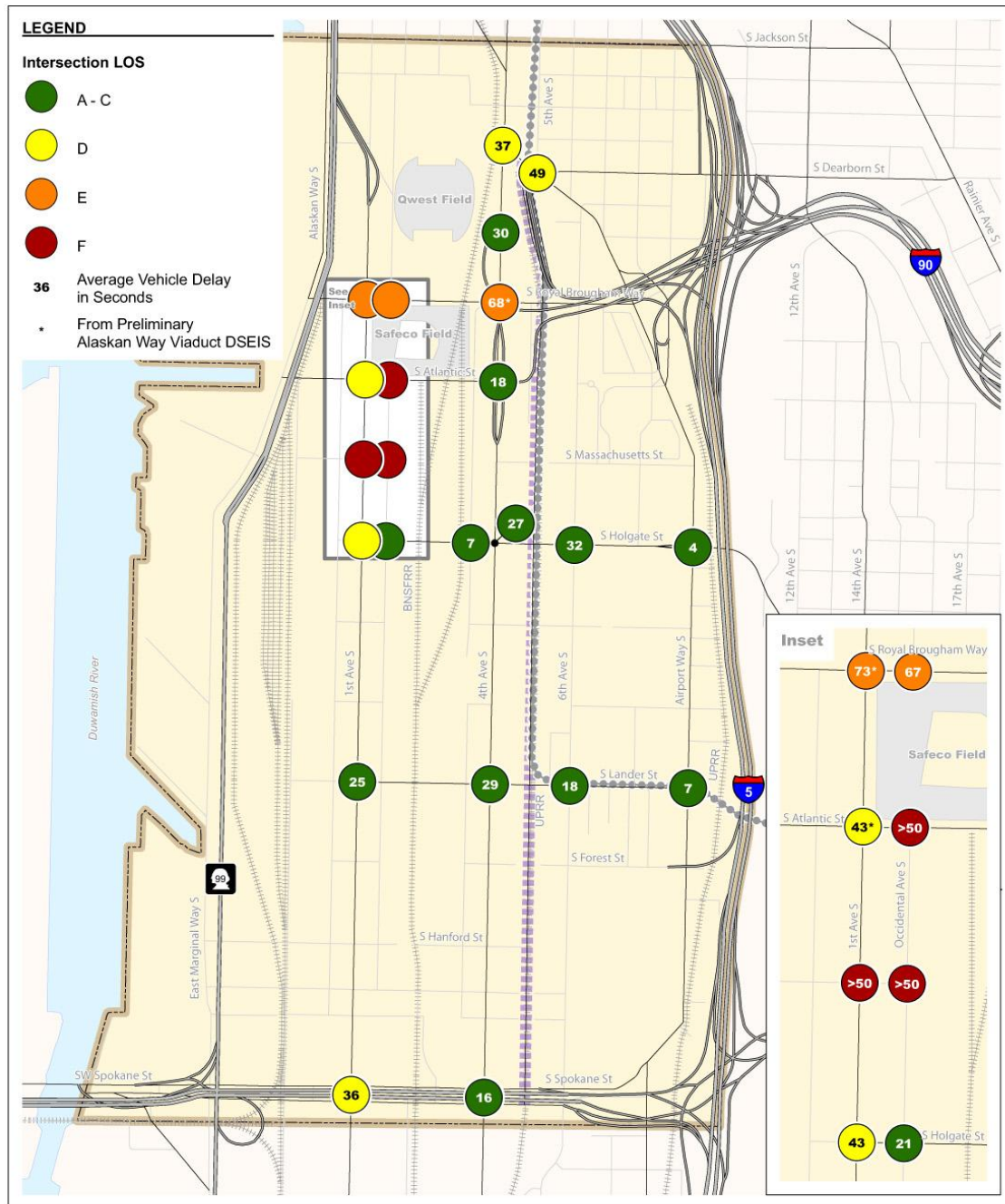


Figure 15. The Distribution Pattern of the PM Peak Period Westbound Traffic on S Holgate Street



Figure 16. The Distribution Pattern of the PM Peak Period Eastbound Traffic on S Holgate Street



fp
FEHR & PEERS
TRANSPORTATION CONSULTANTS
N:\Projects\SE08-0085_SODO_RailroadStudy\Graphics\GIS\Draft\IMXD\fig16_tripDist_EB.mxd

**EXISTING PM PEAK
TRIP DISTRIBUTION -
EASTBOUND**
FIGURE 16

fp
FEHR & PEERS
TRANSPORTATION CONSULTANTS

South Holgate Street Railroad Crossing Study, Phase II

January 2010

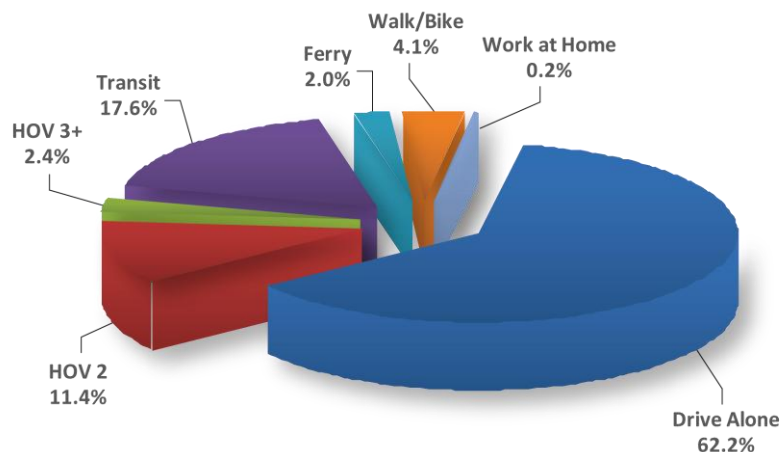
TRAVEL MODES OF COMMUTERS

To understand the use of the existing travel modes for workers and residents, we summarized the home-to-work travel modes using data from the 2000 US Census Transportation Planning Package. **Figure 17** shows the travel mode used by workers with their jobs in the study area. While 62 percent of the workers drive alone, a noticeable percent of the workers use transit and carpool:

- Carpools with 2 or more occupants: 14 percent
- Transit: 18 percent
- Walk and bike: 4 percent

King County Metro does not run regular buses on S Holgate Street between 1st Avenue S and 4th Avenue S. However, as noted earlier, many pedestrians appear to be transit riders who walk to their final destination from the bus stops located around S Holgate Street. It is estimated that the closure of S Holgate Street would significantly impact the bus riders who currently walk to their final destination along this route.

Figure 17. Study Area Workers Means of Transportation from Home to Work



Source: 2000 Census

2015 AND 2030 TRAVEL DEMAND AND TRAFFIC CONDITIONS

TRAVEL DEMAND MODEL

To forecast travel demand for the SODO area and to understand the impacts of the S Holgate Street closure to the streets surrounding the S Holgate Street, Fehr & Peers used the same version of the Seattle Travel Demand Forecasting model that was used for the Alaskan Way Viaduct (AWV) replacement study in 2008. The planning horizon for the AWV study was 2015, and the 2015 model was extensively validated for the AWV project. For 2030, Fehr & Peers used the 2030 Seattle Travel Demand model. Synchro was used to calculate levels of service for the streets surrounding S Holgate Street, and SimTraffic was developed to analyze future traffic operation conditions on S Holgate Street in the stadium area.

Appendix G shows the 2015 and 2030 household and employment forecasts in the Seattle model for the study area. These land use forecasts were prepared by the Puget Sound Regional Council in consultation with the City of Seattle. The study area includes slightly over 100 households today and is projected to increase to over 600 by 2030. The study area included about 30,000 jobs in 2005. The PSRC forecasts an increase to 35,000 jobs in 2015 and up to 38,000 in 2030. These household and employment forecasts were used to develop the Seattle Travel Demand Model.

2015 FACILITY IMPROVEMENT ASSUMPTIONS

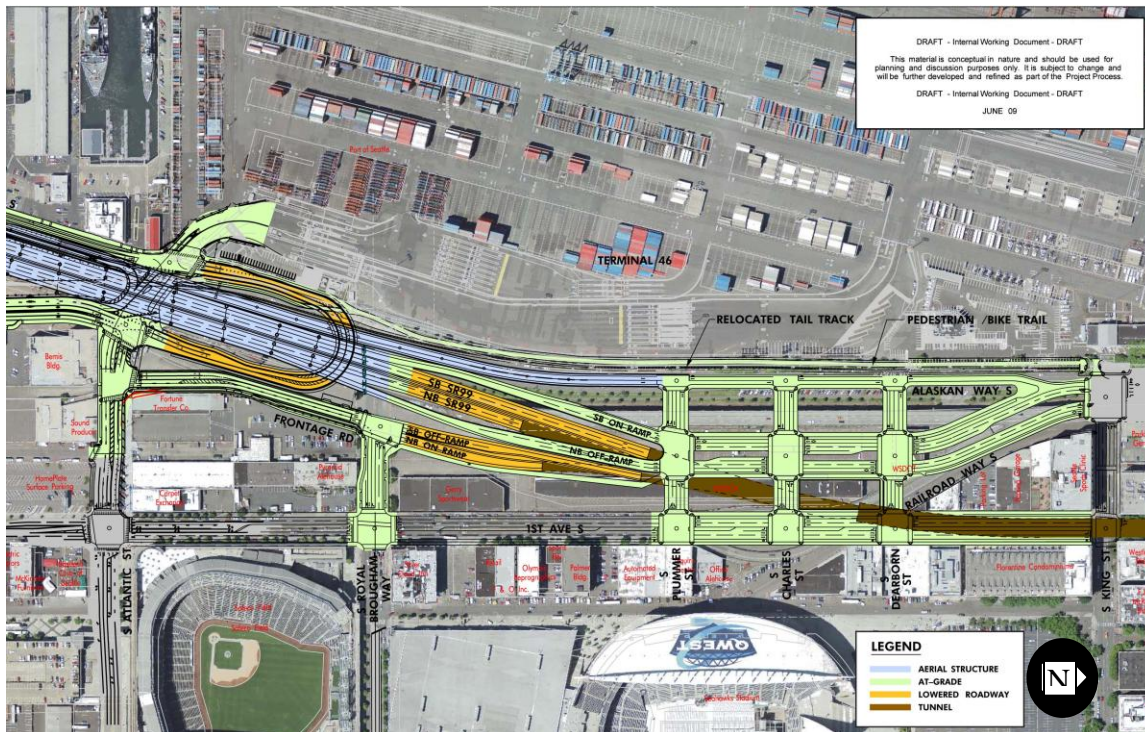
This study used the 2015 Seattle Travel Demand Model with the network called Scenario F in the AWV study, which included the following facilities in the SODO area under the 2015 conditions:

- A bored tunnel with four lanes and no access (ramps) in the tunnel will be constructed from S Royal Brougham Way to Harrison Street.
- A net set of the ramps northbound and southbound ramps in the vicinity of S Royal Brougham Way and SR 99 and surface Alaskan Way will be reconfigured as shown in **Figure 18**.
- HOV lanes on northbound SR 99 from S Holgate Street to term of off-ramp will be provided.
- One-way couplet on Main Street and Washington Street between Alaskan Way and 4th Avenue S will be provided.
- No change to 1st Avenue S between King Street and Cherry Street (two lanes) will take place. (May restrict parking.)
- Spokane Street Viaduct will be widened.
- SR 519 Phase II project will be completed. (We assumed that left turns at the Occidental Avenue S/ S Atlantic Street intersection would not be allowed.)
- Double left turn lanes on northbound 1st Avenue S to westbound S Royal Brougham Way.

Using the 2015 traffic volumes from the Seattle Travel Demand Forecasting model, levels of service at the key intersections in the study area were calculated using Synchro and

SimTraffic. Because of projected high levels of traffic congestion in the future after the completion of the AWV construction in the SODO area, we conducted a traffic operation analysis for the area bounded by S Royal Brougham Way, 4th Avenue S, S Holgate Street and SR 99 with SimTraffic.

Figure 18. Reconfigured SR 99 Northbound and Southbound Ramps and Streets in the Vicinity of the AWV South Portal Area

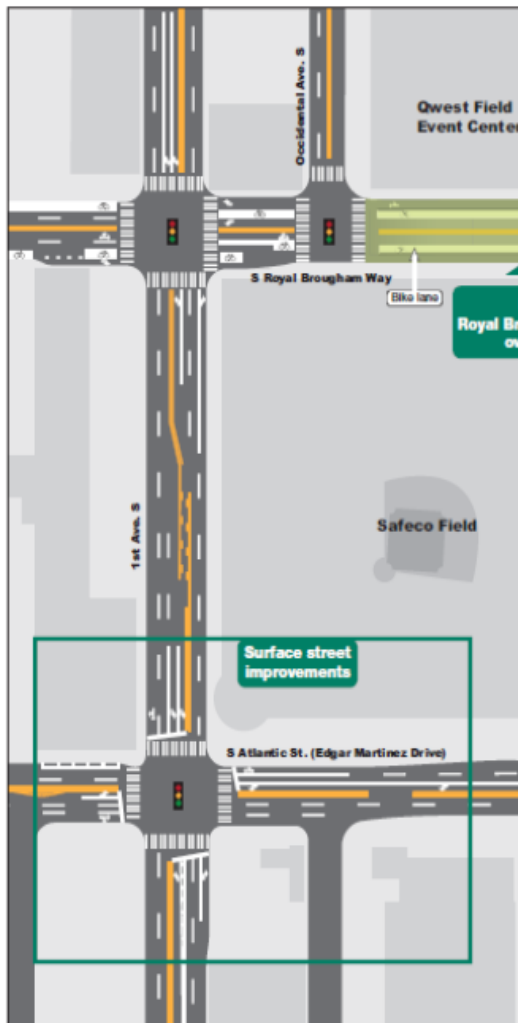


2015 OPERATIONAL ANALYSIS

Fehr & Peers initially evaluated the 2015 traffic conditions keeping S Holgate Street open for traffic. The lane configuration on the S Royal Brougham Way/1st Avenue S and S Atlantic Street/1st Avenue S intersections were taken from the SR 519 Intermodal Access Project Phase II web site as shown in **Figure 19**.

The SimTraffic model assumes that there will be double left turn lanes on northbound 1st Avenue S to westbound S Royal Brougham Way.

Figure 19. Lane configuration on the S Royal Brougham Way/1st Avenue S and S Atlantic Street/ 1st Avenue S intersections



Source: WSDOT SR 519 Website

Figure 20 shows the 2015 levels of service and delays from Synchro and SimTraffic with the assumption of increased capacity at the S Royal Brougham Way/1st Avenue S intersection.

2015 OPERATIONAL ANALYSIS WITHOUT S HOLGATE STREET

Fehr & Peers re-ran the 2015 Seattle Travel Demand model without the S Holgate Street link between Occidental Avenue S and 3rd Avenue S in the network. The PM peak hour demand model volumes were adjusted and added to the Synchro/SimTraffic model. The 2015 PM peak hour levels of service without S Holgate Street are shown in **Figure 21**. The vehicles using S Holgate Street were re-routed to other corridors. The changes in the level of service without S Holgate Street were relatively minor during the PM peak hour.

2030 OPERATIONAL ANALYSIS WITH S HOLGATE STREET

Using the 2030 Seattle travel demand model with the bored bypass tunnel as the replacement for the waterfront section of the AWV structure, the 2030 travel volumes for the arterials in the SODO study area were obtained. Those volumes were used as input to the Synchro/ SimTraffic model to evaluate levels of service at the major intersections.

Figure 20. PM Intersection Level of Service – 2015 Base Conditions

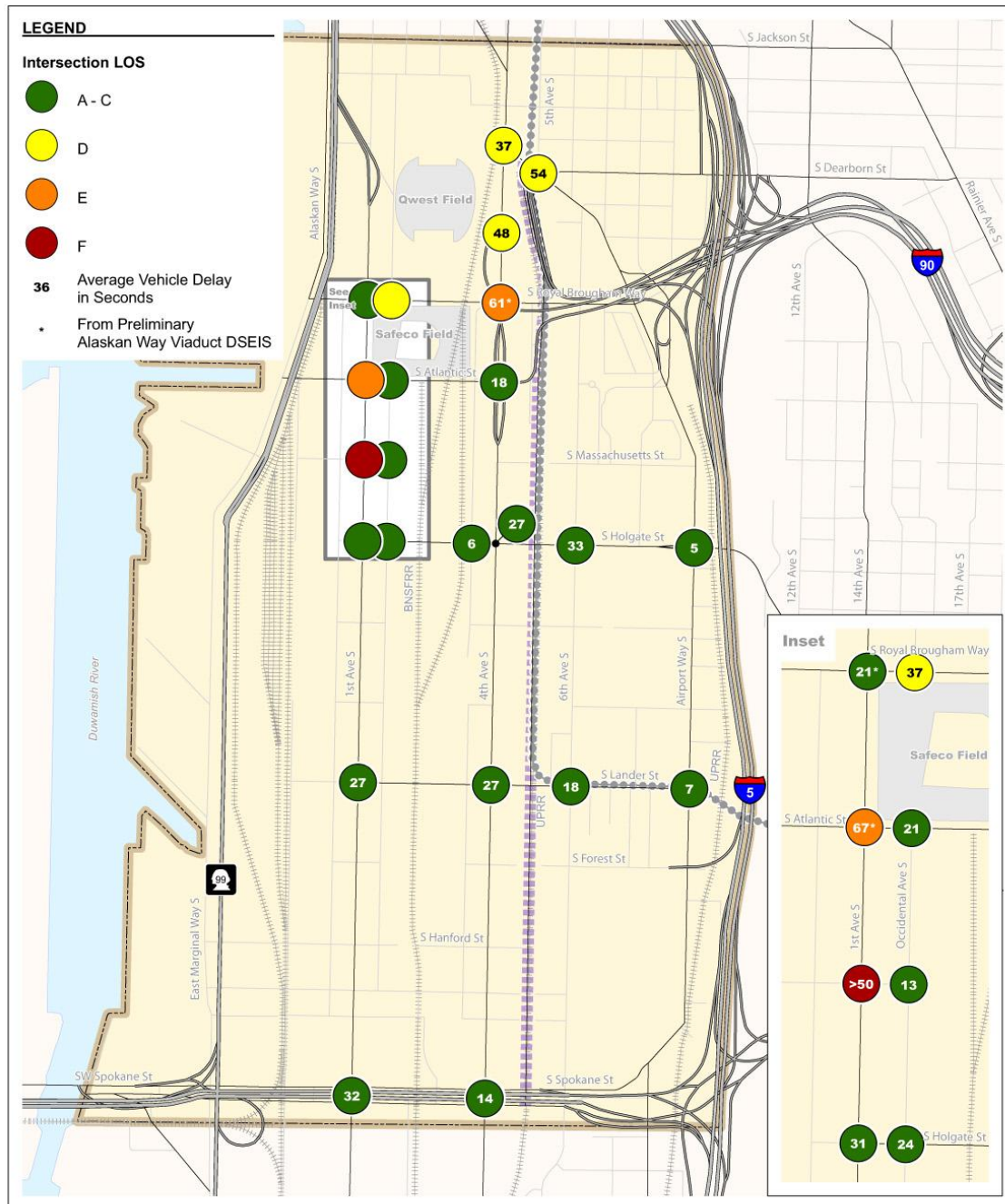


Figure 21. PM Intersection Level of Service – 2015 with South Holgate Street Closure

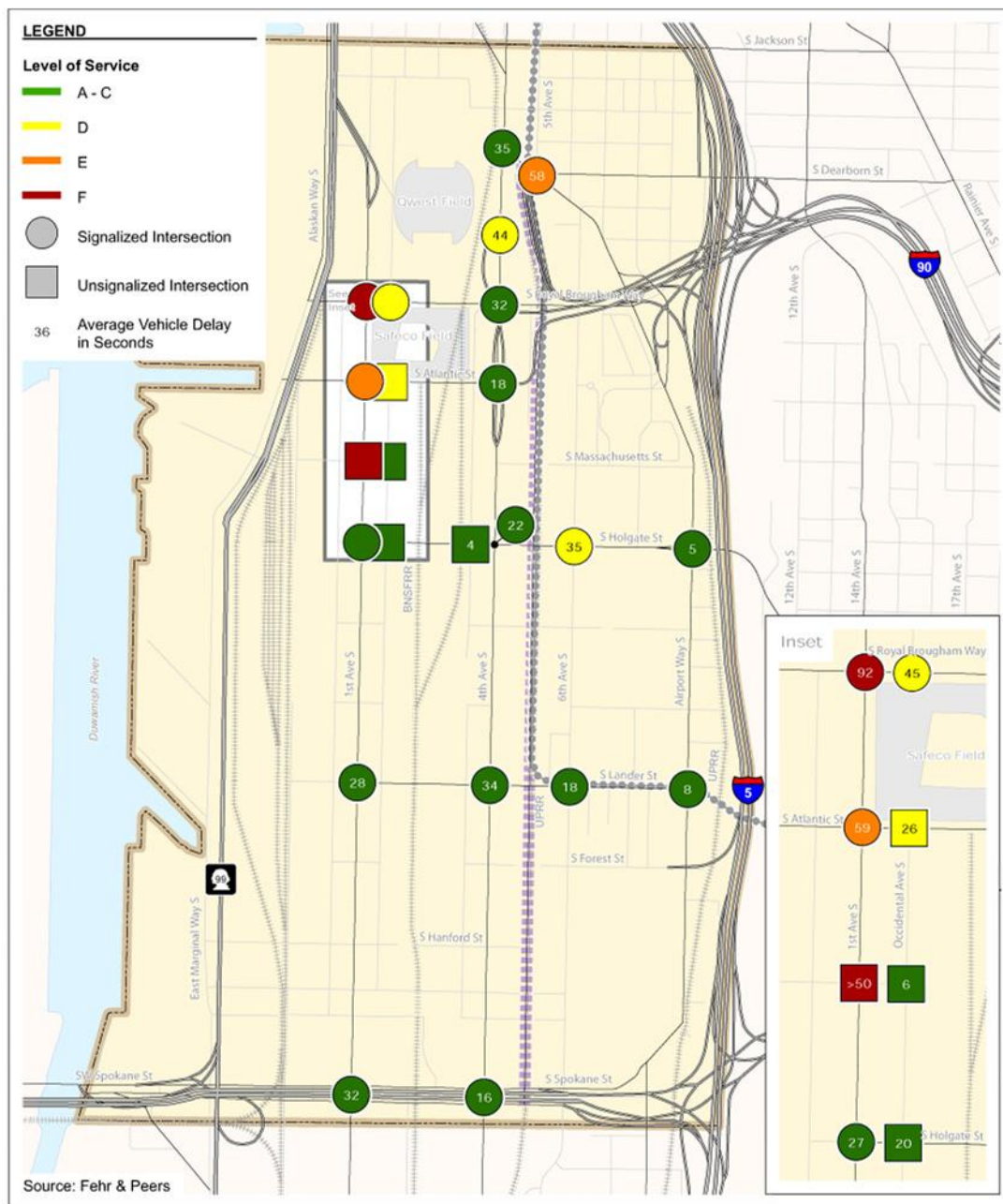
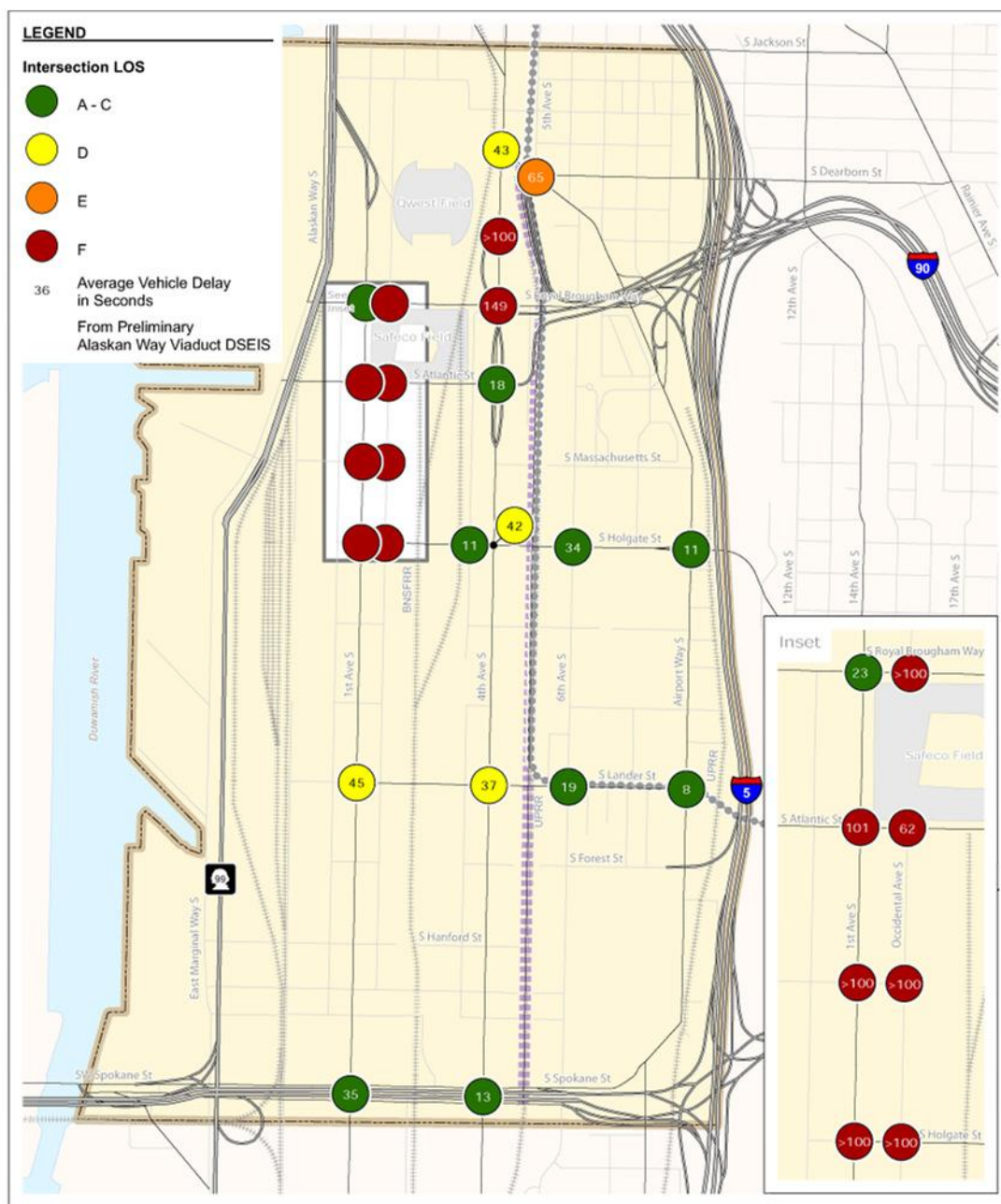


Figure 22. PM Intersection Level of Service – 2030 Base Conditions



The analysis showed that the vehicle travel demand throughout the study area would increase substantially from 2015 to 2030, particularly on 1st Avenue S. Even with the additional capacity assumed for the 2015 analysis at the 1st Avenue S/S Royal Brougham intersection the capacity at this intersection will not meet projected 2030 demand. This intersection would need further capacity expansion. For 2030 we assumed the following:

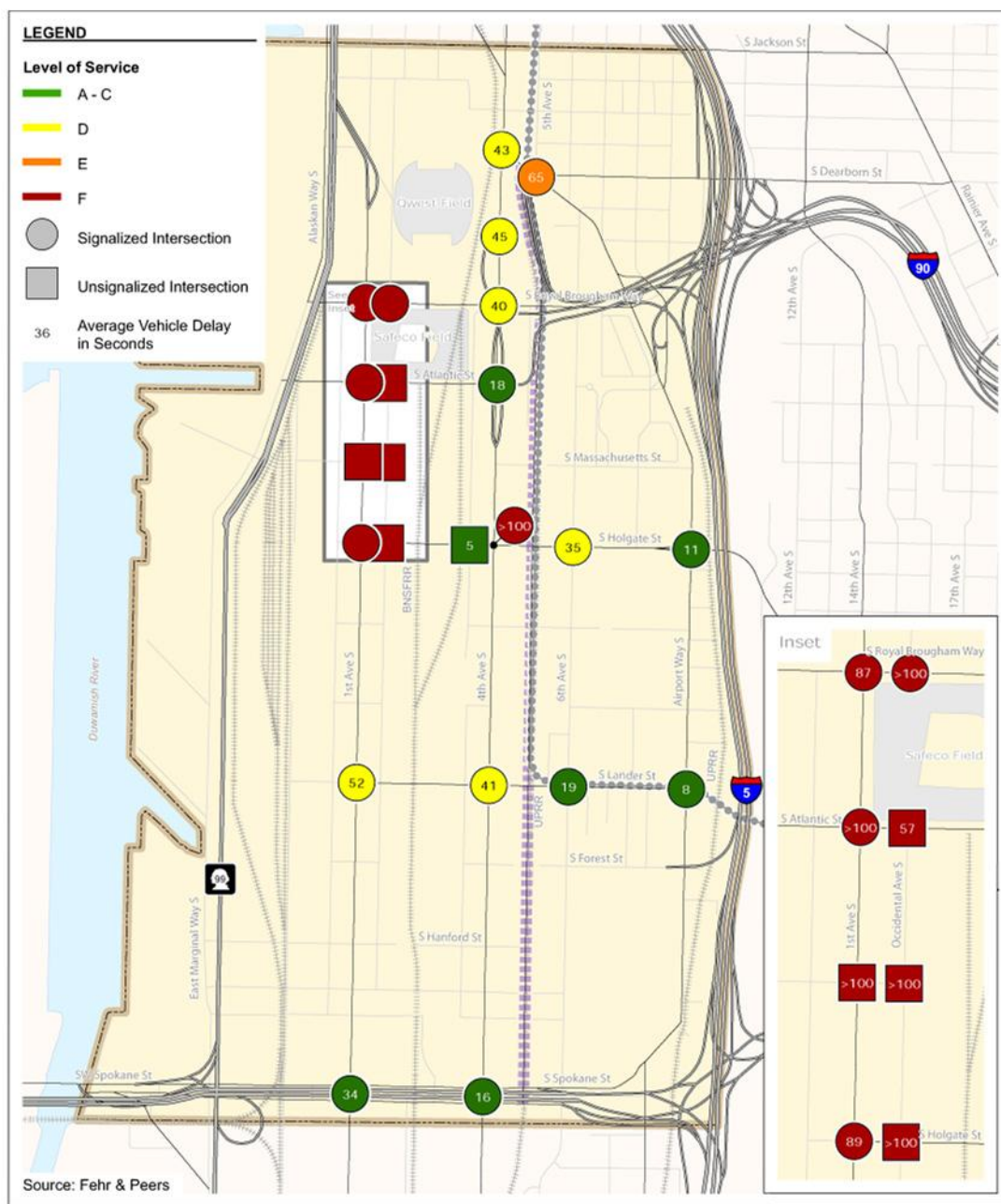
- Double northbound left turns on 1st Avenue S approaching S Royal Brougham Way as assumed for 2015.
- Increased capacity westbound and eastbound on S Royal Brougham Way approaches to 1st Avenue S. The westbound approach: a left turn lane, a left and through lane, a through lane, and a right turn lane. The eastbound approach: a left turn lane, two through lanes, and right turn lane.
- Increased westbound approach capacity at the S Atlantic Street/ 1st Avenue S intersection: double left turn lanes, two through lanes and double right turn lanes.

Figure 22 shows the 2030 PM peak hour levels of service with the assumption that S Holgate Street would remain open for traffic. The results indicate that about half of the study intersection will operate at LOS F. Many of those intersections will operate with a delay of longer than 100 seconds. Overall, the traffic operations model had trouble analyzing this scenario because of the extreme level of congestion.

2030 OPERATIONAL ANALYSIS WITHOUT S HOLGATE STREET

Figure 23 shows the intersection levels of service without S Holgate Street. Given the very high levels of congestion expected along 1st Avenue S and Occidental Avenue S between S Royal Brougham Way and S Holgate Street, it is difficult to compare traffic operations between the closure/no-closure scenarios at these study intersections. Outside of this area, the delay and LOS results between the two scenarios are similar although the closure scenario results in slightly less congestion along 4th Avenue S north of S Atlantic Street and slightly more congestion along S Lander Street Between 1st Avenue S and 4th Avenue S.

Figure 23. PM Intersection Level of Service – 2030 with South Holgate Street Closure



FEHR & PEERS
TRANSPORTATION CONSULTANTS
N:\Projects\SE08-0085_SODO_RailroadStudy\Graphics\GIS\Draft\MXD\fig23_LOS_PM_2030_HC_2.mxd

**PM INTERSECTION LEVEL OF SERVICE -
2030 WITH SOUTH HOLGATE STREET CLOSURE**
FIGURE 23

Chapter 5. Options for South Holgate Street

Based on the information assembled, analyzed, and summarized in the previous sections, the following options for SDOT regarding S Holgate Street were identified:

- Option 1.** No action – Keep S Holgate Street open for traffic with no additional improvements.
- Option 2.** Keep S Holgate Street open and install additional safety enhancements for all modes.
- Option 3.** Close S Holgate Street permanently (vacate right of way).
- Option 4.** Close S Holgate Street permanently for vehicles only and provide a pedestrian/bike overpass.
- Option 5.** Close S Holgate Street for part of the day depending upon level of railroad traffic.
- Option 6.** Construct a grade-separated crossing structure to span railroad tracks.

In the following section, each option is discussed in slightly more detail and pros and cons for each are provided.

OPTION 1. NO ACTION – KEEP S HOLGATE STREET OPEN FOR TRAFFIC

With this option, SDOT and the railroad agencies would not take any actions, and thus the street would continue to operate in the same way it operates today.

PROS:

- No new capital cost.
- Maintains the street grid for all modes of transportation which promotes mobility and access, particularly for area businesses.
- Continues to meet event traffic circulation needs.
- Provides flexibility to transit operations for events.
- Freight vehicle circulation needs will not be impacted.
- Will not contribute to degradation of vehicle level of service.

CONS:

- Does not address the safety concerns expressed by railroad operators.
- Pedestrians will continue to walk on street edges. The sidewalk in certain segments will not be provided.
- When the railroad gate is closed for a long time, drivers in the queues may be frustrated and make unsafe maneuvers such as uncontrolled U-turns or driving around the gates to get around an on-coming train.

OPTION 2. KEEP S HOLGATE STREET OPEN WITH SAFETY ENHANCEMENTS

With this option S Holgate Street would be kept open for traffic. SDOT and the railroad operators would work together to implement actions that enhance safety for all modes of transportation.

The following list identifies the possible safety improvements that the SDOT and the railroad operators could make in this corridor:

- Consolidate crossing gates. (Currently multiple gates are placed on S Holgate Street between Occidental Avenue S and 3rd Avenue S. The purpose of this action is to prevent drivers from queuing up at one gate and extending into the next gate.)
- Install quad-gates. (The quad-gates are designed to prevent a vehicle from going around the gate when a train is crossing S Holgate Street. A typical train gate design is to stop the traffic flow in each direction. Therefore, two gates are needed. The quad-gates are designed to prevent vehicles from going around the gate facing the traffic flow.)
- Construct sidewalks where needed on S Holgate Street between 1st Avenue S and 4th Avenue S.
- Add crossing gates for pedestrians. (Attach a pedestrian scaled gate to each of the quad-gates to prevent pedestrians from crossing the railroad tracks when a train is approaching. Figure 18 that shows the pedestrian gates.)
- Provide raised medians. (Many railroad workers walk across S Holgate Street along the railroad tracks. The raised medians would provide a space for them to wait for adequate breaks between vehicles on S Holgate Street, and additionally create conditions where they only need to cross half of the street at a time. Medians also deter drivers from driving around standard crossing gates.)
- Add U-turn routes. (When drivers encounter a long train gate closure, they should be able to make safe U-turn to choose an alternate route to cross the railroad tracks, for example at S Lander Street.)
- Provide electronic message signs for drivers on area arterials to show when the train gates are down and provide an indication of how long the gates may be closed.

A possible cross section of the S Holgate Street is illustrated in **Figure 24**. The S Holgate Street right of way is approximately 130 feet wide. The sidewalks should be a minimum of 6 feet. If there is enough space for a sidewalk to be wider than 6 feet; a 10-foot planting strip could be added on each side to better separate the pedestrians from the traffic.

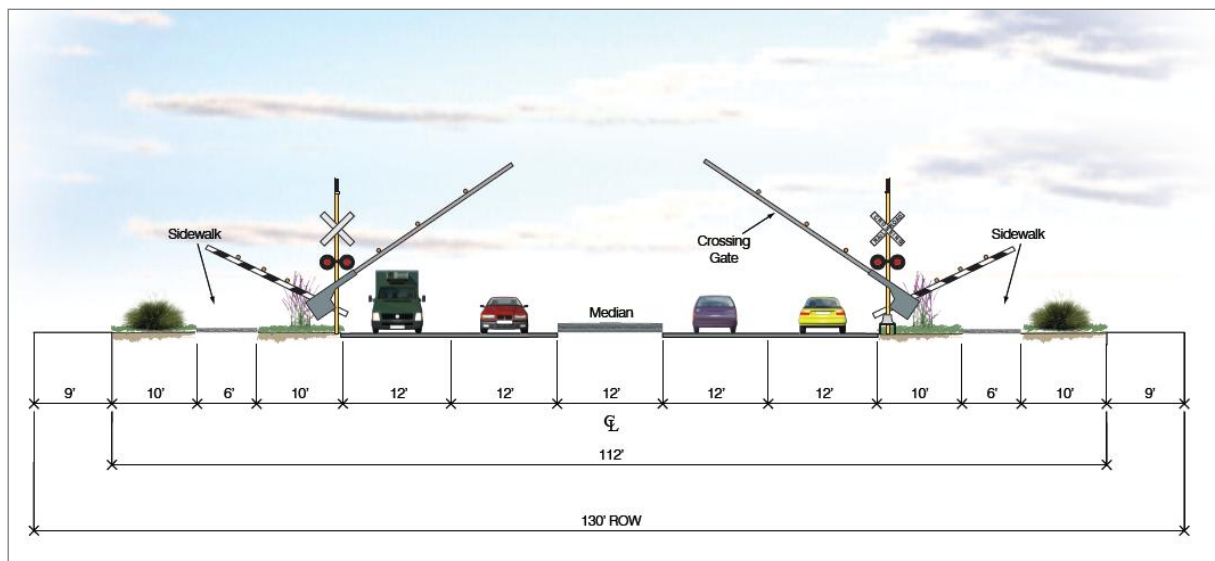
PROS:

- Fiscally feasible.
- Addresses safety concerns of the train operators.
- Maintains City street grid network and supports mobility and access for all modes.
- Reduces risk exposure for pedestrians.

CONS:

- Does not directly address Amtrak's desire for long-term maintenance efficiencies and facility security.

Figure 24. A Possible Cross Section for S Holgate Street



Source: Fehr & Peers

OPTION 3. CLOSE S HOLGATE STREET PERMANENTLY

With this option S Holgate Street would be closed between the east and west sides of the railroad tracks for through traffic, as well as for pedestrians and bicycles. This option assumes that the closed section of S Holgate Street right-of-way will be vacated. The option also assumes that the driveways located between Occidental Avenue S and the west railroad track would remain open; and that the intersection at 3rd Avenue S will continue to operate as it does.

PROS:

- Low cost to implement.
- Likely to increase efficiency for operations of the rail maintenance facilities.
- Eliminates the potential for rail/vehicle and pedestrian collisions.

CONS:

- Will increase traffic in other corridors.
- Will take a longer time to discharge vehicles from the stadium areas after a ballgame.
- Will force pedestrians to take circuitous routes to cross the railroad tracks and some pedestrian trips may be precluded given the distance to alternate routes.

- It may increase the pedestrian-train collision risk due to the pedestrians who may refuse to take alternative routes.

OPTION 4. CLOSE S HOLGATE STREET PERMANENTLY FOR VEHICLES ONLY AND PROVIDE PEDESTRIAN/BIKE OVERPASS.

This option would close S Holgate Street for vehicles only and a pedestrian overpass would be constructed over the railroad tracks. This option recognizes that the options for pedestrians to take alternative routes are limited, if S Holgate Street were to be closed permanently. This option would add some cost to Option 3.

PROS:

- Likely to increase efficiency for operation of the rail maintenance facilities.
- Eliminates the potential for rail/vehicle and pedestrian collisions.

CONS:

- Will be expensive to construct pedestrian overpass.
- Will increase vehicular traffic in other corridors.
- Will take a longer time to discharge vehicles from the stadium areas after a ballgame.

OPTION 5. CLOSE S HOLGATE STREET FOR PART OF DAY DEPENDING UPON LEVEL OF RAILROAD TRAFFIC

This option would close S Holgate Street for part of day aiming at the period when the train gates are down most frequently and for long periods of time. This option assumes that the train activities are concentrated during certain time periods and that the gate closure times are not evenly distributed throughout day.

PROS:

- Maintains some traffic capacity. However, how much traffic capacity can be provided depends on the duration and time of the opening.

CONS:

- Likely create confusion for drivers.
- It will be difficult to identify the best time of day for the S Holgate Street closure. Figure 6 (page 16) shows that the average closure time during AM peak period, midday period and PM peak period is evenly distributed. However, the evening period from 6 to 10 PM has a higher closure time than other periods.

OPTION 6. CONSTRUCT A GRADE-SEPARATED CROSSING STRUCTURE TO SPAN THE RAILROAD TRACKS

This option would construct a grade-separated structure over the railroad tracks. Because of the short distance between Occidental Avenue S and the western railroad track and between 3rd Avenue S and 4th Avenue S, it would not be possible to design an overcrossing that just goes over the railroad tracks. One of the concepts that Fehr & Peers developed for this option is shown in **Figure 25**. This concept includes a long structure that starts at about the intersection of S Massachusetts Street and S Occidental Avenue. It continues with a ramp up to a structure that turns 90 degrees at the S Occidental Avenue/S Holgate Street intersection and continues on to about 8th Avenue S and connects just west of an existing ramp to the existing structure that crosses I-5. Ramps to 4th Avenue S and 6th Avenue S from the elevated structure would have to be provided. The elevated structure would need two lanes with sidewalks on both sides. **Appendix K** provides more discussion on how this option was developed and analyzed.

We have not prepared a cost-estimate for this concept. However, it is estimated that the cost could be more than \$ 40 million dollars.

PRO:

- Addresses all the negative impacts of the closure option.

CONS:

- Very expensive and unlikely to be funded within a reasonable time.
- The benefit/cost ratio would be low. (The benefit would be average travel time saving for the vehicles that travel S Holgate Street on the overpass roadway. While there will be travel time savings with the overpass, the cost is too high to be a reasonable cost benefit ratio that would put this option to a high priority project in the City's Capital Improvement Program.)
- This option would impact 4th Avenue S and 6th Avenue S as additional rights-of-way are needed to add the ramps.

Figure 25. Possible Grade-Separated Structure over S Holgate Street



Source: Fehr & Peers

Chapter 6. Conclusions and Consultant Recommendation

CONCLUSIONS

- Unlike many commercial areas of the City, the SODO area does not have a traditional street grid network. In particular, the number of east-west arterials in this area is limited. A recent decision to construct a grade-separated structure over the railroad tracks on Royal Brougham Way S will further constrain the east-west traffic movements. In 2008, S Holgate Street carried about 12,000 vehicles per day. The closure of S Holgate Street would not shift this amount of traffic to just one street such as S Atlantic Street, but the impact of the street closure would be felt throughout the area.
- The video recording of the train crossings revealed that the train gates stop traffic movements about 20 percent of day (about 12 minutes each hour). More than 50 percent of those gate closures are due to freight train operations. As Sound Transit's commuter rail, WSDOT's Amtrak Cascades, and intercity Amtrak passenger train services increase in the future, the frequency and duration of the train gate closures would increase, resulting in longer delays for vehicles. However, even if the gate closure time were to increase significantly, S Holgate Street would still provide significant access for the area.
- Prior studies did not assess a possible closure upon pedestrians. As stated earlier, there are limited east-west street connections in SODO. Any closure of S Holgate would force pedestrians to walk considerable distances to either S Lander Street or S Atlantic Street. On the winter weekday during the video monitoring, 330 pedestrians crossed the tracks; on a baseball game day, between 5 and 7 PM, 426 people crossed the tracks. In addition, on a typical workday, Amtrak employees made 350 crossings of S Holgate.
- S Holgate Street primarily serves SODO businesses, industries, and the stadiums. In addition, S Holgate Street serves the people who live in the Beacon Hill neighborhood and travel to the waterfront or to the northwestern part of Seattle, such as Interbay or Ballard, for work or shopping. The closure of S Holgate Street would reduce accessibility for those people living on Beacon Hill and others east of I-5.
- As S Holgate Street is located 0.75 miles south of the King Street Train Station, the northbound passenger trains need to slow down as they pass the S Holgate Street crossing to come to a complete stop at the King Street Station, and similarly the southbound trains need to accelerate gradually after departing the train station. The closure of S Holgate Street would not help increase speeds of the passenger train operations.

A grade-separated overpass that carried all modes was considered, but preliminary analysis indicated that this was not a feasible option given its high estimated cost. The challenge presented by the overpass option is that there is not sufficient space to ramp up at a reasonable grade between Occidental Avenue S and the western railroad track, and to ramp down between the eastern track and 3rd Avenue S. A description and schematic design for the bridge structure necessary to achieve the needed clearances is provided later in the report.

While no reported collisions have taken place on the tracks, involving trains, safety remains a chief concern of both SDOT and the railroad operators. These concerns can be addressed through the implementation of achievable and effective safety improvements which will be described in the next section of this report.

RECOMMENDATIONS

Fehr & Peers recommends:

Option 2 - Keep S Holgate Street Open with Safety Enhancements.

S Holgate Street is an important link in the SODO street network. It is one of the limited east-west arterials that businesses and industries rely on for access throughout SODO. S Holgate Street carries about 12,000 vehicles per day; any closure of the roadway would negatively affect local business delivery and circulation, as well as shift traffic to the limited number of the other east-west arterials in SODO. A closure of S Holgate would also force pedestrians and bicyclists to walk and ride considerable distances to either S Lander Street or S Atlantic Street to travel in an east-west direction. *(However, if in the future (post-Viaduct replacement), conditions change significantly, such as a very major upturn in the number and duration of gate closures, the implementation of the S Lander Street Grade Separation Project or Amtrak's willingness to help fund a pedestrian and bicycle overpass over S Holgate Street, SDOT would consider revisiting the question of the long-term role of S Holgate Street).*

Currently, railroad crossings halt traffic movements about 20 percent of the day. Planned increases in through movements by freight and passenger trains will not significantly increase closure times. Future maintenance activities by Amtrak, in particular, such as coupling and de-coupling, cleaning, train repair, cannot at this time, be forecast with any accuracy, therefore, known future conditions do not warrant closure.

Safety remains a chief concern for both SDOT and the railroad operators. These concerns can be addressed and the railroad crossing at S Holgate Street can be modified to enhance safety for all transportation modes without a full closure of S Holgate Street. SDOT should work with the railroad operators to implement the following safety improvements as high priority capital improvement projects.

- Consolidate crossing gates.
- Install quad-gates.
- Construct sidewalks where needed on S Holgate Street between 1st Avenue S and 4th Avenue S.
- Add crossing gates for pedestrians.
- Provide raised medians.
- Add U-turn routes.
- Provide electronic message signs for drivers on area arterials to show when the train gates are down and provide an indication of how long the gates may be closed. Although closures of S Holgate Street by train, for more than 10 minutes at a time, do not occur frequently, there were a number of such occurrences while recording rail crossings in January 2009. The purpose of the recommended dynamic message

signs (DMS) is to inform drivers who are intending to cross the tracks of potential excessive delay before they enter S Holgate Street from 1st Avenue or 4th Avenue. A train gate closure detection device would need to be installed and the duration of the closure should be monitored. In addition, a detection device to monitor vehicle queue lengths from the train gates to S Holgate Street should be installed. When the gates are in a lowered position for some defined time period (for example, more than five minutes), a warning sign for the drivers should be displayed. The exact wording of the sign should be evaluated more in detail at the implementation stage.